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CHANGES for advertisements should be in this office by Friday noon for the following week's issue.

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ELECTROTHERAPEUTICS.

The American Electrotherapeutic Association will in all probability have an exhibit commensurate with the dignity of this branch of research at the World's Fair at St. Louis in 1904. The action taken by this association at its recent convention is at once commendable and practical. While there is great opportunity for pseudo-scientists to taint the progress made along these lines with charlatanism, the painstaking and legitimate search of esteemed members of the medical profession after truth in this direction should be encouraged in every way possible. Outside of the application of the Rœntgen rays in various methods, there has been little done except in certain modifications of the treatment of nervous lesions with mild currents. But there has been real progress thiswise, and permanent benefits have been reported from such treatment. The American Electrotherapeutic Association numbers among its members those who have won distinction by their good works. By all means let us have an electrotherapeutic exhibit at St. Louis.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The next twelve months promise to form a very successful year for the American Institute of Electrical Engineers. The excellent progress made during Mr. Steinmetz's term as president will be sustained. Mr. C. F. Scott, the newly elected president, is now planning to extend the good work already accomplished and to broaden the society, and thus make it of greater value to the engineering profession.

The general plan of the meetings as inaugurated by Mr. Steinmetz, and which proved so successful, will be adhered to. This, as is well known, was to devote the monthly meetings to a single topic, or to those closely connected. It is thought, however, that the meetings this winter can be made even more profitable and interesting if less time is devoted to reading the papers, and more to the discussion. To bring out the best in this way, it will be necessary to secure two or three papers by authorities on the subject to be considered, and to have these printed and distributed in advance. Then certain members familiar with the subject will be requested to lead the discussion. In this way the ground can be thoroughly and carefully covered without waste of time. There can be no question as to the value of having all papers distributed in advance. It is extremely difficult to listen to two or three papers read in abstract only, and then to discuss them concisely and effectively. Evidently, this innovation can not be carried out successfully unless the authors of the papers finish them and send them in in good time.

It is time now that the society increased materially in numbers. Electrical engineering is becoming such a broad field and covers so many lines of work, and is so closely in touch with the other engineering professions, that there is every reason for thinking that the membership of the Institute might well be recruited from other engineering bodies to the mutual benefit of all parties. Indeed, the conditions are such that the Institute should be the strongest in point of numbers of any technical society, and a persistent effort should be made to raise the membership roll to the strength it ought to have. Would it not be well to encourage the younger members of the profession also to become associate members? Many of them do not known that they are eligible, while others who do would gladly join if the benefit of so doing could be presented to them. The very placing of their names upon the roll gives them a certain position in the ranks of their profession and is the first step toward the acquaintance that brings merited recognition. In saying this we do not wish to intimate that the requisites for full membership should be lowered.

As to the benefits which would accrue to the Institute from increased membership, these are several, and would in turn react as a benefit to individual members. In the first place, there is the additional weight and importance of numbers—the possibility of the many securing advantages and concessions where the few might fail. Second, the increased income, which would enable the Institute to secure for itself a home commensurate with its real dignity and importance. We can even imagine that a member visiting New York would feel more benefited by having a comfortable place to lodge and dine and to meet fellow members socially than from attendance at any special Institute meeting. At least, it hardly seems proper that the Institute should be dependent upon another society for the necessary accommodations for its meetings.

THE PASSING OF THE FIREMAN.

Each advance in any industry implies the discarding or superseding of older methods and appliances for those better

and more economical, and brings a corresponding increase in the application and use of the process in which the improvement has been made. The stage coach was replaced by the steam locomotive, and the remarkable expansion of traffic following this change has been too frequently discussed to need comment. Now, steam locomotion is threatened by electric. For short-distance hauls the change is not far off, while somewhere in the future—how near we can not say—lies the substitution of electricity for all methods of transportation now in use.

The relative advantages of the two methods we will not consider here save in one respect—the elimination of one factor in the system. When the use of fuel on the locomotive is abandoned the presence of the fireman becomes unnecessary, and he will consequently be transferred to some other position advancing, probably, to that of motorman.

At the power station, also, changes are going on, though with somewhat different results. Here the introduction of mechanical stokers, whereby the labor of handling the coal is performed by machinery, enables one man to take the place of several in the older method. Moreover, his work is of a somewhat different character, requiring better training and bringing more responsibility. He now has only to regulate the furnaces so that combustion takes place under the best conditions, and see that the machinery is kept in good working order. The position becomes more important under the changed conditions, and demands a man with more education and better judgment than was the case before. In fact he becomes an operating engineer, while before he was little more than a day laborer.

Doubtless there will remain a few instances where the fireman will persist, due to certain local conditions. But it does not require much foresight to see the occupation of the fireman universally replaced by that of an engineer trained in the proper handling and use of fuel. The proper conditions of combustion are not less important than the correct adjustment of the engine valves. The advance has been general, with injury to none, but benefit to all.

In passing, we may call attention to the general changes which are going on in industrial processes. Mechanical methods are replacing, to a large extent, manual labor, and these demand men with better training. Some students of social problems are fearful lest the so general education of the masses may leave no one for the meaner drudgery. What if instead there be a possibility that the progress of invention along these lines may leave a scarcity of work for the unskilled laborer?

WIRELESS TELEGRAPHY.

Wireless telegraphy still receives a good deal of attention from the scientific and technical press. The work which is being done by the various inventors has been recorded, and their systems have been described with considerable detail as to the apparatus and its arrangement.

There has been, however, a lack of discussion in these descriptions of the objects aimed at, and the reasons for much of the apparatus used are not touched upon. Doubtless the various inventors are working with a definite object in view, and every piece of apparatus has a specific purpose; but to the majority of readers it must seem as if they were working along cut and try methods.

We should like to see some logical discussion of the development of these different systems. They must all attain similar results by equivalent methods. While some hold to one theory of the method of propagation, and others to another, the results are identical in kind at least, if not in magnitude. If the inventors are really working according to certain assumptions, this does not appear in the printed descriptions.

There is also a lack of practical application. That this system of transmitting intelligence will replace the land and ocean lines in the near future does not seem probable. A large number of experimental plants have been installed, but none of commercial importance, except, perhaps, those on the larger steamers, and at prominent seacoast points. Now, there would seem to be a number of circumstances where wireless telegraphy could be put to a useful and practical test without replacing, or even competing with, the methods at present in use. One of these seems worthy of examination. With the usual block system of operating railroads, there is no way of reaching a train after it has left one station until it reaches the next. Some years ago a method of telegraphing to moving trains, by means of a wire stretched parallel to the road, was tried, but evidently it was not found altogether successful, and was soon discarded. Why should not some of these methods of wireless telegraphy be tried? The difficulties do not seem great, while the value of the experience gained would be enormous. If the application were found to be successful, the gain to the company and to the general public in the additional safety secured would be inestimable. The prevention of one serious accident would repay, in the saving of confidence and money, an enormous expenditure for experimental work. There would be no need of transmitting orders to the train, though there would probably be little difficulty in doing so. The simple lighting of a lamp in the engine cab would suffice to warn the engineer of danger. To-day most well-equipped trains already carry an electric installation, which could furnish the necessary power on the train, and the additional apparatus required need not be expensive nor complicated. The proposition would seem worthy of more careful consideration by the railroad companies.

Maybe Marconi didn't invent wireless telegraphy. But he is doing things with his apparatus right along.

The statistics just made public of the German export of manufactures of iron to Russia show that for electrical machines the number of pieces amounted to 3,077 and the value $1,384,500, or an average of $450 per unit, in 1900; for 1901 the number of pieces was 2,650 and the value $1,060,000, or an average per unit of $400—a decrease of twenty-three per cent in number of pieces and of eleven per cent in unit values. Russia is not buying any less. Where is the difference coming from? Perhaps the American exporters can tell.

HIGH-TENSION WORK IN THE FAR WEST.*

BY GEORGE H. LUKES.

To the central station man of the East or the Middle West, the tremendous development in high-tension transmission in the West, and particularly on the Pacific Coast, seems marvelous and inexplicable. Each issue of the electrical journals seems to chronicle some new achievement more remarkable than all before. Distances and line voltages have been doubled and quadrupled, and the whole country from Old Mexico to British Columbia is dotted with transmission plants. It is not the purpose in this paper to take up the subject of long-distance transmission in any detail, for to do this would require a volume, but it is rather to point out some of the conditions that brought about this rapid development and the trend of growth at the present time.

The great mountain ranges that lie about 150 miles from the coast and extend north and south are the sources of innumerable streams of water that reach the Pacific through the larger rivers. These streams are of small volume except at time of flood, but on the other hand, the fall is exceedingly rapid so that it is not unusual to find heads utilized of from 500 to 1,500 feet, and even more. The installations consequently are of one general type with variations here and there to suit local conditions. A dam is thrown up at some point on a mountain stream where a reservoir can be created, and from this dam the water is carried by means of a wooden flume, ditch, or, in some cases, a wooden stave-pipe line, with a grade of from five to twenty-five feet per mile to a point where the maximum drop can be utilized. From the penstock, the pipe line which is sometimes of steel, sometimes of cast iron, or, in cases of low head, wooden stave pipe, is run down to the power-house below. The water-wheels are of the Pelton type and are direct-connected to alternating-current generators, which supply two or three-phase current at a frequency of sixty and a voltage of one or two thousand. The exciters are direct-connected to separate water-wheels. The raising transformers are of the water-cooled oil-insulated type, and are generally located in a room separated from the dynamo room by fireproof walls. The lightning arresters are usually in a separate building to cut down the danger from fire. The high-tension switchboard is mounted on insulators and consists of wooden frames upon which are placed air-break switches of various types. The high-tension bus-bars are simply extensions of the transmission lines and are bare wires mounted on insulators like those used on the lines. The transmission lines will be described in some detail later.

Turning now to the commercial side of the proposition, it is evident that until there was sufficient market for power there could be no long-distance transmission plants. Moreover, to make transmission of power necessary, natural conditions must also exist to prevent the utilization of power at the point where it is generated. In the West the power plants are necessarily located in the bottom of deep cañons in mountainous districts miles from any railroad, so that the market can not move to the power and the power has to be transmitted or not used at all. For well-known engineering reasons electrical energy can not be transmitted efficiently over long distances, except in large amounts, and this calls for a large market for power. In California this market grew slowly, as the industries of the country became diversified. In the early days mining was the principal industry, but as the country grew older it was discovered that, with irrigation, large crops could be raised in the fertile valleys. The country became more thickly populated and towns grew into cities. With the introduction of electric lighting and electric railways a great demand was created for electric power.

The cost of fuel is the factor which determines whether or not a market exists for power transmitted from a distance. California has no coal beds to speak of, and hence the coal has to be imported. About three-fourths of the supply comes from British Columbia and Washington, and is semi-bituminous and lignite. As the country is practically covered by only one railroad there is no competition, and freight rates to interior points have been excessive. The price of fuel and therefore the cost of power have been very high. In 1890 oil was discovered in Southern California and has since been largely used for fuel. The consumption rose in 1900 to 4,000,000 barrels. The cost of fuel has fallen somewhat in consequence. As oil has only partially displaced coal, its price naturally hovers about that of coal, and the expectations of an extremely cheap fuel have not been realized. Still, from the point of view of the power transmission man, the discovery of oil was a most unfortunate event.

Thus for forty years prior to 1890 the conditions had been slowly getting more favorable for long-distance transmission. A large amount of experience had been gained in the construction of dams, flumes and pipe lines. A water-wheel suitable for the purpose had been evolved, and a market for power in large quantities had grown up. A method of transmitting power over long distances was lacking until the Frankfort-Laufen transmission experiments were made in 1891. In less than two years after these experiments, the historic Pomona transmission of thirty miles at 10,000 volts was in actual commercial operation in Southern California. Since that time the development has been very rapid, the capacity of transmission plants alone now aggregating upward of 100,000 horse-power.

At the present time these enterprises are much more carefully planned than in the early days. The pioneering days are over to a certain extent and the second stage of development has begun. It has been demonstrated that it is possible to transmit energy in large quantities for distances up to 150 miles and over. With the extension of the lines into large cities for the supply of electric lighting and power for street railways the policy is followed of spending more money in first investment in order to secure reliability of service and low operating and maintenance costs. This tendency is shown in the hydraulic end by the substitution of tunnels and paved and cemented canals for wooden flumes. Duplicate pipe lines are now provided and the power-house itself is built in a more substantial manner and as nearly fireproof as possible.

The pole line has been found to be the weakest part of the transmission system, and I give some of the details of the construction of the latest pole lines in order to show the care and foresight now displayed in this part of the work.

The poles commonly in use on the newest transmission lines are either of square sawed redwood, tapered from butt to top, or Oregon or Washington cedar. The Oregon cedar poles used by the Bay Counties' Company in its lines from Colgate to Oakland a distance of 142 miles, are painted with hot tar from the top of the pole to a point six inches below the bottom cross-arm. The butts are saturated with hot carbolineum for three and one-half feet where the pole enters the ground.

The redwood poles are from the hearts of young trees, not more than four poles being taken from one tree, and being free from sap when set, they will last from twenty-five to thirty-five years.

(To be continued.)

*Abstract of paper read before the Association of Edison Illuminating Companies, September 9, 1902.

The Convention of the Association of Edison Illuminating Companies.

The twenty-third convention of the Association of Edison Illuminating Companies was held last week at the Mount Washington, White Mountains, N. H. The proceedings began on Tuesday, September 9, with an address by the president, Mr. Louis A. Ferguson, of Chicago. In the course of his remarks Mr. Ferguson paid a deserved compliment to the work done by the various standing committees, particularly the lamp and meter committees and also the storage battery committee appointed last year for the first time. He advocated an extension of the work done by the appointment of additional standing committees to collect data and formulate opinions for the use of the members of the association. Among these should be standing committees on other kinds of illumination which competes with electricity, on steam turbines, on rates, on relations with kindred societies and on theft of current. He spoke strongly upon the importance of devoting more time than has hitherto been spent on mechanical and theoretical problems which arise in connection with the progress of the electrical art. He also referred to the proposed action of the National Board of Fire Underwriters in reference to high-potential currents, and urged upon the members the importance of giving their closest attention to the proposed changes in the rules of the national board, so that the electrical industry would not be prejudiced thereby.

In submitting the report of the committee on high-potential conductors, the chairman, J. W. Lieb, of New York, spoke of the proposed action of the National Board of Fire Underwriters in limiting the use of high-potential conductors in the vicinity of buildings, and of the desire of various representatives of electrical bodies to secure harmonious cooperation with the National Board of Fire Underwriters without sacrificing the interests of the industry. In conclusion, Mr. Lieb proposed that the name of the committee should be changed to that of the Committee on the National Code, in order more clearly to define its functions. The sessions of the convention were held each day from 9.30 A. M. to 1 P. M., and each evening from 8 to 10.30 o'clock. This allowed the whole of the afternoons for excursions and golf playing. Various forms of entertainment were thoroughly enjoyed by the delegates and their ladies, and prizes were tendered by different prominent members of the association. The General Electric Company acted as host on Friday, and invited the members of the association and those who accompanied them to luncheon at the Summit House, Mount Washington. Those who accepted this invitation were taken up the Mount Washington Railway on specially reserved cars. The convention was one of the most largely attended which the Edison Association has ever had, and also one of the most enjoyable, not only in regard to the scenery and the perfection of the hotel accommodations, but also to the fine weather which prevailed during the sessions of the convention.

A number of splendid papers were read, the published programme being carried out without variation with the exception of the paper by Mr. Steinmetz, which was not given, owing to the unfortunate circumstance that Mr. Steinmetz was unable to be present. All of the old officers of the association were reelected.

Sixth Annual Convention of International Association of Steam Engineers, Pittsburg, Pa., September 8, 1902.

The sixth annual convention of the International Association of Steam Engineers occurred at Hotel Henry, Pittsburg, Pa., September 8, 1902, and was called to order at 9 A. M. by President Lighthall.

J. L. Richardson, of Local Union No. 95, Pittsburg, and chairman of joint reception committees, welcomed the delegates, being followed by the Hon. Guy McCandless, of Pittsburg, who extended to the delegates the freedom of the city.

After a few well-chosen remarks President Lighthall appointed the committee on credentials, composed of the following: S. L. Bennett, Kansas City, Mo.; Joseph Hammell, New York city; C. A. Kirby, Chicago, Ill.; John A. Bader, Detroit, Mich.; James J. McCracken, Washington, D. C.

Committee on Rules — William H. Walsh, New York city; John Henry, Saginaw, Mich.; E. F. Murphy, Glens Falls, N. Y.; W. H. Betts, Toledo, Ohio; J. F. Reiling, Fort Wayne, Ind.

The convention then adjourned until 2 P. M.

At 2 P. M. President Lighthall called the convention to order, after which the committee on credentials made its report. Following is the list of qualified delegates up to September 8: P. A. Peregrine, J. W. Wood, J. J. Maguire, George V. Lighthall, Charles A. Kirby, H. W. Phillips, A. W. Huddell, J. D. Bader, S. L. Bennett, R. A. McKee, W. H. Betts, J. J. Walsh, S. Theakston, J. F. Reiling, W. H. Walsh, J. F. Hammell, F. J. Schmitz, P. McMahon, A. J. Skiffington, A. Kessler, John Henry, W. H. La Fore, M. Comerford, J. H. Higgins, D. W. Gilbert, J. P. McDonough, G. Muirhead, C. Friermuth, Dewitt Turner, S. L. Bennett, J. C Hannahan, H. Cunning, J. J. McCracken, W. A. Worcester, W. J. Coakley, P. M. Boyle, M. J. Curran, C. P. Samsville, H. F. McConbrie, E. F. Murphy, J. Hyder, Jr., L. J. Griffin, J. J. Gloss.

The subject of credentials for delegates was closed after discussion by Delegates Lighthall, Bennett, Gilbert, Comerford, Henry, Hammell and Walsh.

The committee on rules then reported recommending commencement of sessions at 8.30 A. M. to continue until 12 M., and afternoon sessions from 1.30 P. M. until 6 P. M.

An order of business was recommended, also rules limiting debate to recognized and accredited delegates, the limit as to time being placed at five minutes.

Morning session, September 9, was called to order by President Lighthall, and committees on by-laws, grievances, resolutions, officers.

The report of General President Lighthall was then read.

In this report he dealt with the wonderful growth in membership of the union during the past year.

After a number of recommendations concerning the stamp system, journal, seals, election of officers annually, beneficiary fund, accident, death and sickness, the general secretary's report was read ending August 31, 1902, reporting a balance of $3,211.45, the expense of the year running $9,604.36.

The convention then authorized the selection of a fraternal delegate to attend the annual meeting of the Steam Engineers of Canada and that he shall be elected at the regular election of officers on Saturday. It was understood that the Canadian organization desired to unite with the International Union of Steam Engineers and it was considered important to send a delegate who could arrange all details by which the forty Canadian unions could be affiliated.

The annual banquet took place at the Hotel Henry Thursday night.

Matters of importance to the union were considered in executive session from which the public was excluded.

The annual election of officers then took place, with the following results:

President, Geo. V. Lighthall, Chicago.

First vice-president, P. McMahon, of Jersey Heights, N. J.

Secretary-treasurer, R. A. McKee, of Peoria, Ill.

The next annual convention will be held in Wheeling, W. Va., the first Monday in October, 1903.

After adjournment many of the members remained in Pittsburg until Tuesday, visiting the Edgar Thompson and Duquesne steel works and the Westinghouse Electric and Manufacturing Company's plants.

Street Railway Association of the State of New York.

The annual convention of the Street Railway Association of the State of New York was held at Glens Falls, N. Y., September 10. Papers were read by Mr. A. C. Tulley, purchasing agent of the Metropolitan road; Mr. R. S. Stanforth, of Rochester; Mr. C. B. Fairchild, of New York; T. E. Mitten, of Buffalo; W. B. Reed, of Syracuse, and Joseph A. Towers, of Troy, N. Y.

The officers were elected as follows: President, G. Tracy Rogers, of Binghamton; first vice-president, Edward G. Connette, of Syracuse; second vice-president, Addison B. Colburn, of Glens Falls; secretary and treasurer, Henry A. Robinson, of New York. The following gentlemen compose the executive committee: G. Tracy Rogers, of Binghamton; H. H. Vreeland, of New York; W. Caryl Ely, of Buffalo; T. J. Nicholl, of Rochester, and J. L. Greatsinger, of Brooklyn.

The convention next year will be held at Syracuse, when the delegates will be the guests of the Syracuse Rapid Transit Company.

The International Association of Municipal Electricians.

Present indications point to a large attendance at the seventh annual convention of the International Association of Municipal Electricians. The association meets at Richmond, Va., October 7, 8 and 9, 1902. The headquarters will be at Murphy's Hotel. Members of the association and guests intending to take part in the convention exercises will leave New York on Saturday, October 4, at 3 P. M., from Pier 26, North River, foot of Beach street, arriving at Richmond at 7.30 A. M. Monday, October 6. Transportation will be furnished by the Old Dominion Steamship Company. Round-trip tickets, including meals and stateroom, cost $14. An elaborate entertainment has been arranged en route. Mr. F. C. Mason, 16 Smith street, Brooklyn, N. Y., will furnish any desired information, and will reserve staterooms if requested. The papers have been printed and bound up in pamphlet form, and will be distributed for the leisurely perusal of the delegates. The papers will not be read, but will simply be announced by title and fully discussed.

The Annual Meeting of the Pennsylvania Street Railway Association.

The annual meeting of the Pennsylvania Street Railway Association, held at the York Country Clubhouse, York, Pa., September 10, was called to order at 1.30 P. M. In the absence of the president, Mr. John A. Rigg, Mr. Henry C. Marsh was elected chairman of the meeting.

Hon. M. B. Gibson, Mayor of York, was introduced and delivered an address of welcome which was responded to by the chairman. About thirty-five railway companies were represented, and among the manufacturers might be mentioned the following: The Continuous Rail Joint Company, represented by B. M. Barr; the Heil Rail Joint Welding Company, by C. J. Harrington; J. G. Brill Company, by W. H. Huehlings and J. Ellwood Bradley; the General Electric Company, by R. E. Moore; John A. Roebling's Sons Company, by Charles Cushing and Foster Ivins; Lobdell Car-Wheel Company, by F. A. Lex; Westinghouse Electric and Manufacturing Company, by T. Cooper and C. A. Bragg; Lehigh Car-Wheel and Axle Company, by B. F. Swartz; Columbia Machine Works, by W. F. Kerschner; H. C. Roberts Electrical Supply Company, by C. M. Maxwell and John Mustard; Western Electric Company, by Fred C. Joege; the Electric Storage Battery Company, by Edward L. Reynolds; Sawyer-Man Electric Company, by George W. Simpson.

The following officers were elected for the ensuing year: President, E. H. Davis, Williamsport Passenger Street Railway Company; first vice-president, Edward Bailey, Harrisburg Traction Company; second vice-president, W. W. Greist, Canestoga Traction Company; secretary, Charles H. Smith, Lebanon Valley Street Railway Company; treasurer, W. H. Lanius, York Street Railway Company; executive committee, E. H. Davis, C. H. Smith, B. F. Myers and John A. Rigg.

The first paper read was on "The Most Economical Management of the Repair Shop," by Charles S. Banghart, superintendent of repair shops, United Traction Company, Reading. This paper was greatly appreciated, and embodied essentially the requirements which, from a good mechanical and electrical standpoint, are necessary for the economical management of both ordinary and extraordinary repairs. The different requirements of machine-shop practice were taken up in detail and ably discussed by the author. Particular attention was paid to the taking up of specifications and the economical maintenance of car equipment, and also proper instruction of all employés operating such equipment in order that close cooperation might be had with the operating employé and the repair man.

Another paper was on "The Practical Construction of Suburban and Interurban Electric Railways," by S. S. Hoff, civil engineer, Reading, Pa. This paper discussed at some length the construction of the road-bed and the relations which should properly exist between the investor, the manager, the manufacturer, the local civic authorities and the urban, as well as the suburban, populace. The author remarked in detail upon the questions of franchises, the preliminary survey, the selection of the general route, the building up of proper road-beds, the avoidance of sharp curves and unnecessary grades, the proper strengthening of embankments, the masonry, which should enter into bridge work, and the great necessity of establishing a thorough system of drainage for all road-beds. He then took up in order the question of the emplacement of ties, the size and weight of rails and the bonding of rail joints, which should, more than any other point, be given the serious practical consideration of the engineer and construction man. Concealed bonding, he considered, was the best for practical construction, and the less liable to be loosened by vibration or careless interference by trackmen at their ordinary repair work, as well as affording protection against robbery. With the right of eminent domain accorded to the steam road charter—which should also be extended at least to the interurban electric road—the author thought it was possible to complete an electric road capable of being operated safely and successfully at any rate of speed to which the electric system of the future may be developed.

The delegates were the guests of the York Street Railway Company on September 10 on a trolley ride to Windsor and return. At 8 P. M. the same day a complimentary smoker was given at the York Country Club. On September 11 a complimentary excursion was tendered over the West Maryland Railroad to Gettysburg, with a drive over the battle-field.

The place of meeting for the next convention was referred to the executive committee.

Second General Meeting of the American Electrochemical Society.

The Opening Exercises at Niagara Falls, N. Y., September 15, 1902.

THE second general meeting of the American Electrochemical Society was called to order by President J. W. Richards in the music room of the International Hotel, Monday, September 15, at 10.30 A. M., following immediately after the directors' meeting at which fifteen of the eighteen directors were present. There were about 100 members and guests present.

Report of the treasurer showed that the finances were in excellent condition, and that after all liabilities had been met there would be a balance of over $600 in the treasury. The secretary reported that the growth in membership had been very encouraging and that there were now 411 members.

Dr. F. Haber, of Karlsruhe, was introduced as delegate from the German Electrochemical Society and courteously welcomed by the president.

The reading and discussion of papers were then taken up.

The first paper was by Mr. F. A. J. Fitzgerald, of Niagara Falls, on "Notes on Testing Carbon Electrodes." The nature of the carbon of the electrodes depends to a large degree upon the method of preparation. Not only does the density vary, but the per cent of graphite present is different in the different processes of manufacture. Pure graphite is less affected than amorphous carbon in electrolytic processes, and it is therefore important to have some method of testing both as to density and amount of graphite present. In finding the density a sample is carefully weighed and then placed in a volume meter and a known volume of kerosene added. The total volume is then noted. Then the vessel is attached to an exhaust pump and all the air withdrawn and the total volume read again. From these are deduced the apparent density, the real density and the porosity. These are found to vary for different portions of samples as well as for different samples. The test for amorphous carbon consists in oxidizing the sample with repeated washings of nitric acid and potassium chlorate. This treatment removes the amorphous carbon and leaves the graphite as graphite oxide. In the discussion, Professor W. H. Hart suggested the use of persulphuric acid to separate the two forms of carbon. Mr. Fitzgerald stated that this had not yet been tried.

President J. W. Richards then read his paper on the "Efficiency of Electric Furnace Operations." There are three kinds of operations. The first is the electrolytic. Here the voltage is partially absorbed in overcoming the counter-electromotive force set up by the material being decomposed. Here the efficiency is the ratio of this voltage to that actually used. Furnaces proper are of two kinds—continuous and intermittent. In the first the furnace is charged and brought up to the proper temperature and then by continuous feeding in the process is kept up. In this furnace the efficiency is the ratio heat used to heat developed in the furnace. The loss is that due to radiation. In the other type the furnace is charged and then brought up to the temperature of reaction when it is allowed to cool. The heat radiated from this time is useful and can not be considered as loss. The loss is only the heat radiated while the furnace is being brought up to the proper temperature. The efficiency varies with size of furnace from ten per cent to ninety per cent, and is higher in those where no chemical reaction takes place. In commercial sizes these have an efficiency of from sixty-five per cent to seventy-five per cent.

In the chemical furnaces the efficiency in commercial sizes is from fifty per cent to sixty per cent. The losses in all furnaces are due to radiation, and hence the better efficiency of large sizes as the radiating surface increases with the square of the dimensions only while the charge or volume increases as the cube. The efficiency of the continuous furnace can be raised by running the charge through rapidly. Figures for the calculated efficiency of various furnaces were given and agreed with those indicated above.

In the discussion Mr. Carl Hering suggested that a rating of pound output per kilowatt-hour was a convenient method of rating furnaces.

Professor Hart called attention to the importance of the study of efficiency in preparing products which can not be transported easily to a distance as nitric acid.

The third paper, on "Additional Notes on Lead Reduction," by Mr. P. G. Salom, was not read as it was not thought advisable on account of certain patents now under consideration. It will be presented at the next meeting of the society.

The fourth paper, by Mr. A. T. Weightman, gave a detailed account of the investigation of the behavior of lead in the cathodic reduction process as now being used at Niagara.

The last paper, by Professor L. Kahlenberg, gave an interesting account of his study of the potential differences between metallic cadmium and solutions of cadmium iodide in various solvents.

A motion was made and carried to refer to the board of managers the question of appointing delegates to the Fifth International Congress of Applied Chemistry which meets at Berlin next July.

In the afternoon the power-house of the Niagara Falls Power Company, the Graphite works and the Lead Reduction works were visited.

The convention continued in session during September 16, 17 and 18, a complete programme of a technical and social nature having been provided by the various committees.

Old Time Telegraphers and Historical Association.

The twenty-second annual reunion of the Old Time Telegraphers and Historical Association and the Society of the United States Military Corps was held September 10, 11 and 12, 1902, at Salt Lake City, Utah. The opening session was called to order by W. C. Burton, of New York. The Rev. P. A. Simpkins delivered an address of welcome, to which Mayor Cochrane, of Montreal, Canada, responded. A series of invitations from authorities and associations in Milwaukee, inviting the association to meet there next year, was read. The choice of the place of meeting was left in the hands of the executive committee, H. W. Pope, J. R. Reid, Z. T. Miller, J. Cochran and John Winthrop. The committee recommended that Milwaukee be chosen as the place of next meeting, and that the time be set during the month of September, 1903. This report was adopted. The same committee was appointed as a nominating one and upon its recommendation the following officers were chosen: President, E. J. Fry, Milwaukee; vice-president, W. J. Lloyd, of Chicago; secretary and treasurer, John Burt.

The executive committee was enlarged and now stands as follows: G. H. Corse, of Ogden; L. D. McFarland, of Montreal; H. C. Hope, of St. Paul, and H. J. Pettingill, of Boston.

At the suggestion of the secretary the association adopted a resolution changing the age limit to twenty-five years' service, five years of which was in actual service prior to twenty years ago.

The Military Corps held a fifteen-minute meeting at the conclusion of the session of the Old Time Telegraphers' meeting, President Ives occupying the chair. He stated that no further appeals for recognition by Congress would be made this year, and appointed E. Rosewater, of Omaha, as an envoy to President Roosevelt, to lay the claims of the telegraphers before him and seek his cooperation. Five members have died since the last session.

ELECTRICAL MINING NOTES.

THE USE OF ELECTRICITY IN COAL MINES IN THE UNITED KINGDOM—A ROYAL COMMISSION APPOINTED TO ENQUIRE INTO THE MATTER.

BY SIDNEY F. WALKER.

The use of electricity in coal mines, while it is going ahead steadily and has become the recognized agent for transmitting power, for lighting, signaling and shot-firing, has at the same time been getting itself into bad odor in several districts. In the recent reports of his Majesty's inspectors of mines two deaths are reported to have occurred from shock and two from accidents to machinery driven by electric motors. The latter may be dismissed, as accidents of that kind are constantly occurring in coal mines, and they are not more likely to occur because the apparatus is driven by an electric motor than by a steam or compressed-air engine. The accidents referred to are such as a man getting in the way of a journey of loaded trams and being run over by them. Lads riding on trams which are being hauled to or from the face of the coal, a practice they are very fond of, but which is strictly forbidden by the act and by the special colliery rules. Men are constantly doing things they have no business to do, thinking they are smart enough to do them without injury, and when they are caught by the machines, if it happens to be driven by electricity, the accident is put down to that agent.

A FATAL ACCIDENT AT A MUSIC HALL STATED TO BE DUE TO ELECTRIC SHOCK.

This is not strictly mining, but it will serve to illustrate the kind of thing that goes on and the justice with which the results are put down to electricity. I give this case, as the victim belonged to the class which is subject to accidents of this kind, perhaps more than any other class, and because I investigated the case myself. The victim was a laborer working at one of the ironworks in Sheffield, and he had been employed to assist the electrician and consequently thought he knew all about electricity. As the sequel proved, he knew just enough to get himself into trouble. He and another man, styled in the evidence an electrician, but who should be described more as an electrical mechanic, and who knew a little more, possibly a good deal more, than the victim (he knew enough not to fool about with electric light fittings), went to a workingman's music hall. They had both been drinking pretty freely, and they had been walking about in the wet since leaving work. They went into the lavatory, where there was a bracket on the wall carrying an incandescent lamp. There was no switch to the lamp, it being turned on or off by putting the lamp in its socket, or taking it out, or by turning the main switch on or off. The bracket consisted of a piece of thin brass tube bent to the curved shape required, the insulated conductors being inside the tube. They were covered with a not too great thickness of vulcanized india-rubber. The victim, standing on a portion of the floor which was covered with lead and very wet, reached up and caught hold of the bracket, bending it by the strain he put upon it, and bringing one of the conductors into connection with the bracket itself. The service was on the three-wire system, 440 volts, alternating, between the outers, the middle wire being earthed. As the conductor made connection with the bracket in the man's hand, he received a smart shock—220 volts, alternating, gives a smart shock—which pulled him off the floor by the contraction of his muscles and thoroughly frightening him. He called out to his friend to pull him off. The friend tried to do so, only succeeding in catching hold of his cheek and receiving a shock himself, the victim who had been disconnected from the service by being lifted off the floor, of course, receiving a second shock also. The man and his friend were so thoroughly frightened that the friend made a supreme effort to pull him down, and succeeded in pulling him back with his head on to another part of the floor of the lavatory, which was of concrete, and he died some little time after, being apparently quite sensible after the fall. A coroner's jury sat on the case, called no medical evidence, did not give any notice to the corporation officials who are responsible for the supply, though they referred very strongly to their absence from the inquest, and on the strength of the evidence of the victim's friend brought in a verdict that the man died from electric shock. I venture to think that if one of your American humorists were to give this case just as it occurred it would pass for genuine humor.

THE DEATHS WHICH HAVE OCCURRED FROM SHOCKS IN COAL MINES.

Unfortunately the two deaths which are reported by the mines inspectors as having occurred in mines from electric shock did so occur, but in my opinion they were caused by the pernicious practice of earthing one side of the circuit in mines. In one case, that at Exhall colliery, in Warwickshire, which I investigated for the colliery guardian, the power service was worked with concentric cables, the outer being uninsulated so that the whole mine formed part of the circuit. It may be observed here that though coal is a very poor conductor, just as water is, when it is present in large quantities, as in coal seams, it behaves just as water does and forms a very fair conductor, provided that good connection is obtained. In the case in question, good connection was obtained by means of water running down the incline, where the accident took place, to a depth of several inches, and the men were standing in the water for hours, stripped to the waist. They were moving a steel girder which formed a portion of the support of the roof of the incline, and as it fell it skinned the cable which was supported by the wooden prop below it. The victim in this case got hold of the girder, which was then in connection with the conductor, and made circuit through his body, receiving a current from a 480-volt service for about ten minutes. It was the time which killed him. In my opinion that man would be alive now if both cables had been insulated, or if insulating material of greater mechanical strength was employed. Part of the trouble in these cases, and in many others, is caused by the ease with which the envelope of the conductor is cut through.

FIRING SHOTS BY ELECTRICITY.

This also has been getting itself a bad name, notwithstanding the fact that it is being increasingly used. One of the mine inspectors reports that the percentage of miss-fires is more than double with low-tension electric fuses what they are with ordinary composition fuses, such as are used when electricity is not employed, and that with high-tension fuses the proportion is as four to one. This, I believe, is due to the difficulty experienced in making high-tension fuses that will fire with the pressure available from the ordinary hand magneto apparatus. The magneto apparatus is itself rather uncertain. Magnets lose their power, contacts play their usual tricks, and so on. But the great trouble is the fuse itself, which consists of two copper wires embedded in fulminate of mercury, or some similar detonating composition, and which is fired by a spark passing through the composition. It will be evident that unless the ends of the copper wires are within a certain distance of each other, the pressure available

will not send a spark across. Also the resistance of the mixture through which the spark has to pass will vary with different conditions, and may vary from, say, hour to hour. The cause of the trouble with the low-tension fuses is usually the rupture of the small platinum wire which forms the fuse, though again it may be due to the failure of the battery. The low-tension fuses generally require about 0.3 ampere to fire them, and this is a large current to take from some of the portable apparatus on the market with certainty.

THE DANGER OF MISS-FIRES.

The great danger involved in miss-fires is, the men who are firing the shot are tempted to go to it, if it does not go off after a certain time, and tinker with it, and the shot may not have actually missed, but be smoldering, and go off while they are near. It is always claimed by electrical men that an electrically fired shot is safe to approach, immediately after the attempt has been made and has failed, but from the reports of the mines inspectors this does not appear to be correct. Coal is not like a cannon, though the action of a shot, which properly performs its work, is exactly like the action of a charge of powder fired in a cannon, the only difference being that the force of the explosion is expended in shattering the coal or rock instead of in expelling the shot. When the shot fires but does not shatter the coal, or the rock it is intended to bring down, the action is similar to the firing of a blank charge from a cannon, the shot hole forming the barrel of the gun. It sometimes occurs that the explosive has not the full power it is supposed to have, owing to proper materials not being used, or to its having been kept, and it also sometimes happens that there are cracks in the coal or rock, especially when the shot is not fired immediately, and the squeeze from the overlying strata has time to operate, and in those cases the shot may be blown out, or it may be expended uselessly, but with danger to the attendants, in the cracks, etc., and may be smoldering. Coal cutting by machinery is tending to reduce, and will probably do away entirely with shot firing, especially in thick seams.

THE ROYAL COMMISSION.

A royal commission is our parliamentary panacea for everything. It is also a governmental method of shelving things. I have no faith in the enquiry by royal commission, but if undertaken by the great engineering societies would be more satisfactory.

THE DESIGNING OF TELEPHONE APPARATUS—II.

BY W. A. TAYLOR.

Gold-plated electrodes or other metallic electrodes have been used by many manufacturers with good results, but there seems to be a difficulty in getting the pure quality of tone that is obtained from a transmitter with carbon electrodes. The quality is apt to be what is described as tinny. A very important quality in an instrument is to produce the voice tones accurately so that the voice of the person talking may be very readily recognized. Because a transmitter has metallic electrodes it is not necessarily saying that it has a defective quality, for there have been some made with a very pure tone, but in these cases only one of the electrodes was metal, the other being carbon. Probably the reason for the peculiar quality given to a transmitter comes from the fact that the current is broken more easily where the contact is between metal and carbon than between carbon and carbon.

The form of the metal electrodes is usually the flat disc shape, and they are used because they are considerably lighter than carbon and therefore possess less inertia. They are cheaper than the carbon and will carry a greater quality of current without burning than the ordinary unpolished carbon. They also make the transmitter somewhat less in resistance. Some makers do not use the flat metal, but use a gold-plated gauge. This increases the surface somewhat, but catches the granules in the meshes and makes them vibrate with the gauge. Thus it is seen that these attached granules assist as electrodes, making the equivalent of carbon electrodes.

The next important step in the design of a transmitter is to choose the granular carbon. Several kinds have been used with varying degrees of success. A number of European manufacturers have shown a preference to globular carbon. This carbon is in the shape of small round balls. It is a mystery how they ever came to adopt this substance, for it gives a very poor result compared with any other kind. It is soft and disintegrates easily; it does not act efficiently, and is apt to sizzle and fry with a very small flow of current. Another and better variety is made from granulated coke carefully screened to a uniform size. This variety gives good results, but is also soft and is apt to have the same faults as the globular carbon, only in a lesser degree. The action of the transmitter seems to powder a portion and this powder gives rise to burning or frying.

No doubt the best grade of granular carbon is the bright, shiny, sharp-cornered granular carbon. The particles of this carbon are very hard and should have a deep, glossy, black hue. All particles should be uniform in size and of as low a resistance as possible. There is nothing to be gained in using carbon, the material of which possesses a high resistance; the resistance should be in the points of contact, as that is the only resistance which is variable. To increase the resistance an entirely different method should be used.

The production of first-class granular carbon has been kept pretty nearly a trade secret, and there has been a great deal of mysterious talk of secret processes and chemical treatment, but, on the whole, it is one of the simplest things about the manufacture of the transmitter. The best grade of granule is made from anthracite coal. Only the purest coal should be used. Cross Creek Lehigh coal is eminently fitted for this, as it is nearly pure carbon having an extremely small percentage of ash and volatile matter in its composition. It is also very hard. The coal should not be taken from the heap at random, but only the clean, shiny, crystalline pieces should be chosen, those showing no stratification or parts having the dull appearance of slate. These pieces have dirt and other impurities and should be rejected, as they will be soft after treatment. The pieces should be broken up to about the size of a walnut and carefully inspected again for the presence of impure-looking particles.

After picking over, place into a graphite crucible and cement the cover on with fire clay. The crucible should then be placed into a furnace and heated to almost a white heat for twelve hours, and then should be allowed to cool before opening. During this process all the volatile matter in the coal is driven off and all other substances are thoroughly carbonized. The chief difficulty in the process is to know when the coal is sufficiently carbonized, for if the coal still contains uncarbonized matter, its electrical resistance will be abnormally high. Care must also be taken to guard against the admission of air while the coal is heated.

After the coal has been thoroughly carbonized it is removed from the crucible, crushed and screened to the proper size. The screening process must be carefully done or the granules will not be of uniform size. A large amount of waste is

always left which is of no use. This waste includes all sizes which pass through a screen of sixty meshes per inch and consists mostly of dust.

This granular carbon will have a dense, jetty black shade, the particles of which will be very brilliant in lustre and intensely hard; in fact, hard enough to scratch glass. The electrical resistance will not be high, and, on account of its hardness and polished surface, will stand very heavy currents without burning. Such carbon as this will have a long life with very severe usage.

As was stated before, there is another way of increasing the resistance of a transmitter besides increasing the resistance of the material substance, and that is by changing the size of the granules. In Fig. 1 it will be seen that extending between the two electrodes, A and B, there is a quantity of granular carbon, C. It will also be seen that the distance between the electrodes permits four particles of carbon to extend, touching each other and the electrode surface, so that there are five contact points from A to B. In Fig. 2 the granules are larger, and but three granules are needed to bridge the distance between the electrodes, D and E, making four contacts. Now leaving the resistance of the material out of the question, the resistance of the carbon, C, in Fig. 1, will be to the resistance of carbon, F, in Fig. 2, as the number of contacts, or as 5 to 4. It will be found that these results work out pretty closely to the above result in practice. A transmitter having a No. 30 carbon (thirty to one inch) having a resistance of twenty ohms normally will have a normal resistance of about from sixty to seventy ohms when a carbon between fifty and sixty gauge is used. It is not exactly proportionate, probably because the lighter weight of the smaller particles will not permit so great a pressure at the points of contact.

The quantity of granular carbon which should be placed in the transmitter of course depends upon the type of instrument. Where the chamber for holding the carbon is very large, as in those with carbon diaphragms, where the whole of the diaphragm acts as an electrode, the weight of carbon would be too great if filled anywhere near full and there would be great trouble from packing. The transmitter would then give very indifferent service. In this class of instrument the granular carbon is filled up to a point about half covering the electrode, where it gives best satisfaction. In the small button transmitters, usual custom is to fill from three-fourths to five-sixths full. A little space must always be left to ensure absolute looseness of the particles.

Separating the electrodes will give an

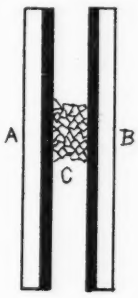


FIG. 1.

increased resistance to the transmitter, but that is not advisable after an efficient separation is decided upon, as the variation of resistance is reduced. The centre particles of carbon would be very little affected by the vibration of the diaphragm. By reducing the size of the electrodes the resistance may be increased also, and this method, together with the reduction in the size of the granules, is the proper way of making any necessary increase in the resistance. In decreasing

FIG. 2.

the size of the electrodes care must be observed not to make them so small that they will not have sufficient capacity to carry the necessary current for efficiently operating the transmitter. In such a case there would be trouble due to frying. Probably the smallest size for this purpose which has proven satisfactory is about seven-sixteenths of an inch.

The question naturally presents itself: "Why increase the resistance of a transmitter?" The reason is that in a local battery instrument just as small a current as possible should be used, in order that the battery power may last a long time. A battery giving a fifth ampere to the transmitter will last three times as long as one which furnishes three-fifths of an ampere. Besides the expense of the battery there is the expense of two extra inspections where the larger current is used. In an exchange of 200 subscribers this item would mean a great deal. Suppose dry batteries were used and with the larger current three charges were required in two years, each telephone required two cells at fifteen cents per cell. The number of cells in this case would be 1,200 as against 400 and the cost $180 as against $60. A good inspector, with wages of $2.50 a day, can inspect not more than twenty-five telephones. The inspection cost on 200 telephones would therefore be $20, and the three inspections would amount to $60. In two years the difference in cost would amount to $160, or $80 per year. At $2 each for transmitters it would pay to make the change from the high-current instrument to the low-current consumer and the saving would pay for the change within five years.

We have not yet taken up the subject of the adjustment of the transmitter. This is distinctly a mechanical feature, but of great importance in the working of the instrument, as it affects the uniformity of the action. All the transmitters should be so made that any number may be made without any variation in the different dimensions. Especially is it necessary that the diaphragms shall all be of uniform gauge and resilience. The damping springs shall all be alike, nearly as possible pressing with the same tension and in the same position in each case. Provision should be made that the electrodes shall be held a certain definite and known distance apart. Toward this end all parts must be made absolutely interchangeable and so that every part is formed exactly alike. This, of course, means expensive tools made especially for this purpose, and while they cost considerable they will quickly pay for themselves on account of the economy in assembling. It never pays to skimp in the toolroom and turn out inaccurate tools, for many times their worth is lost in fitting at the assembling bench, both on account of the time required and because of the skilled help necessary. With good tools cheap help may be used in assembling. This truth applies to all parts of telephone apparatus, and not following it out has proved the ruin of many a manufacturing company. It is always cheaper to do a thing right than wrong.

An Italian engineer named Piscicelli, so the news comes from Rome, has submitted to the minister of posts and telegraphy a unique scheme for the rapid delivery of mails. His plan is, essentially, to transport letters in aluminum boxes on overhead electrical conductors. A commission has been appointed to report on the advisability of instituting an experimental line between Rome and Naples. Between these points the inventor claims he can deliver letters in twenty-five minutes.

THE CONSTRUCTION OF TELEPHONE EXCHANGES—XLI.

BY A. E. DOBBS.

THE LOOP TESTS.

Sometimes an escape, ground or cross, has a very high resistance when compared with its line resistance, as, for example, a pinhole in a cable sheath which would let in moisture enough to ground everything in it and yet a ground test might indicate several hundred ohms, though the total resistance of the cable conductor might not exceed twenty ohms.

It might also happen that this trouble would not develop sufficiently to attract attention until a rainy day, when every conductor contained within the sheath would ground at once. In a case of this kind it is necessary that we should have at least one good conductor to the outer end of the cable in order to make a complete loop with the defective conductors. If we can find one conductor that is well insulated, well and good; if not, we must find or run one temporarily outside the cable. This new conductor should be preferably of the same resistance as the cable conductors; if not, it would be a saving of time and brain fag to insert a few feet of No. 36 wire in the circuit till its resistance is exactly the same as the grounded conductors.

We now join the faulty and the good conductors together at their outer ends, thus making a closed loop, and measure their resistance in the usual way. No matter which of the loop tests is used this is always the first preliminary, as it gives us one of our chief working constants.

THE VARLEY LOOP.

In ordinary tests the junction between A and B is connected to one pole of the battery and the binding-post, D, to the other. We might, therefore, consider the current as flowing forward through the arms, AB, and backward through R from post, D, and line, the rheostat, R, being merely an artificial line used for balancing the real one, the line being merely an extension of the A arm, as R is an extension of B.

In loop tests, however, conditions are changed in respect to the battery connections, because the battery is disconnected from the post, D, and connected to ground, the other ground out on the line taking the place of D, as indicated by the dotted line and arrows in Fig. 175.

We now have not only the line extension of the A arm, but also a line extension to R, whose resistance is unknown and can not be found, so far as the rheostat alone is concerned. But the side BR *a*, which is the grounded side, must balance A *r*, which is the "clear" side, and, being able to find three sides of our circuit, we are enabled to find the unknown resistance to the contact between the line and the earth by a comparatively simple formula.

It does not matter what the resistance of the earth contact might be, provided there is battery enough to deflect the galvanometer needle. If the resistance is a

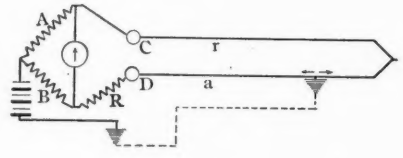


FIG. 175.

high one it may be necessary to use an outside battery of even fifty cells in order to secure a clear definition of the needle.

In all the formula

r equals the total resistance of the loop between the binding-posts C and D.

a equals the resistance from "D" to fault.

A, B and R equal the bridge arm resistances unplugged.

First—Measure the resistance of the loop, *r*, in the usual way.

Second—Disconnect the battery from

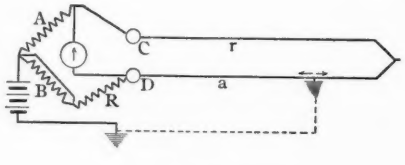


FIG. 176.

the stud, D (Fig. 176), and connect the stud, GR, to ground by means of a traveling plug to which a ground wire is attached.

Third—Connect the faulty wire to the post, D, and the good one to C.

Fourth—Manipulate the bridge arm till a balance is obtained. If the ground is only a short distance away, or it seems probable that the resistance will be low, 1,000 in the A and 10 in the B arm is a good working ratio.

Fifth—When a balance has been obtained it will be found that

$$a = \frac{B \times r - A \times R}{A + R}$$

a being the resistance of the faulty conductor from D to its contact with the ground, the distance to the fault in feet will be this resistance divided by the resistance per foot or hundred feet; or if the mile is the unit, then by the resistance of the conductor per mile.

Sometimes a check test is used, which consists in reversing the ratio arm connections connecting A to R and B to X, and connecting the faulty conductor to C instead of D. This is measuring out on the ground conductor and from the junction back to the ground and reverses our formula which now reads—

$$a = \frac{a \times r - B \times R}{A + B}$$

Problem 1: Several conductors in a cable show cross-talk very badly, and the insulation is evidently giving out. A hasty test to ground in the regular way shows a resistance of several hundred ohms, thus indicating a probable water-cross which must come from a puncture in the sheath. The conductors are No. 20 B. & S. G., and when the few remaining good pairs are looped at the outer ends they measure forty-eight ohms. Using one of the good conductors for a Varley loop test with B = 1,000, A = 10, *r* = 48, while R balances at 3,678.

How many feet to the trouble?

Solution: We must find the resistance of *a* by means of the first formula

$$\left(a = \frac{B\,r - A\,R}{A + B}\right) = \frac{1{,}000 \times 48 - 10 \times 3{,}678}{10 + 1{,}000} =$$

$$a = 11.109 \text{ ohms.}$$

The resistance of this cable conductor being about 10.26 ohms per thousand feet

$$\frac{11.109}{10.26} = 1{,}082 \text{ feet—}Answer.$$

This can also be reduced to proportionate length of cable if the total length of the cable is known. Thus, the resistance of one conductor would be one-half that of the loop or twenty-four ohms, which in the above case would give 2,340 feet as (24 ÷ 10.26) the length of the cable. Or in other words, the distance in feet may be taken without regard to changes of temperature or possible resistance of cable splices by calling half the resistance of the loop *l*, the resistance to ground *a*, the length of cable *f* and the distance to the fault *m*. It can be stated by proportion as, $l : a :: f : m$ or $m = \frac{a\,f}{l}$ which in

the above case would be $\frac{11.109 \times 2,340}{24} =$ 1,082 + feet, which makes our calculation somewhat easier than to reduce the resistance of the wire to foot ohms and divide a by the result.

This loop might be worked on an even bridge, but the results are not so close in low-resistance measurements. A few tests and measurements, however, will enable one to commit the above simple formula to memory.

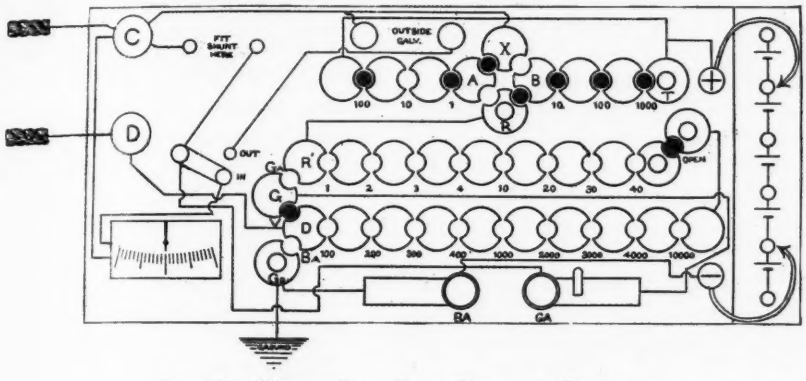


FIG. 177.—MURRAY LOOP TEST—LAYOUT OF BRIDGE.

While this loop is not quite so simple as the Murray loop it possesses the advantage—to the man who uses the bridge only occasionally—of requiring no rearrangement of the bridge set except to disconnect the battery from D and connect it to ground.

THE MURRAY LOOP.

This plan is the favorite one among engineers who have had a great deal of experience in bridge work, even though it does involve a rearrangement of the connections. In the first place, the arm B is entirely eliminated by plugging up all its coils, the rheostat arm (R) taking its place (Fig. 177). The galvanometer connection is also shifted to the outer end of the R arm, making the neutral point D instead of the junction between B and R. The faulty conductor is connected to the rheostat side as in the Varley loop. We also, in our formula, use the same letters as above indicated (a, distance to fault; r, that of the loop, and A and R, bridge arms).

The formula used is: $a = \frac{R\,r}{A + R}$

This result may be checked up by reversing the line connections, placing the good conductor on C and the faulty one on P, which will measure the long side of the loop.

Formula $a = \frac{A\,r}{A + R}$

Problem 2: Connected as for the Murray loop A = 1,000, r = 70 and R at 639. What is the value of a and how many feet to the fault?

Solution: $\frac{R\,r}{A + R} = \frac{639 \times 70}{1,000 + 639} =$ 27.29 ohms—*Answer.*

As to our second proposition, neither the length of the cable nor the conductivity of the wires is given, so that we can only give the answer as a percentage of the entire length. As the loop equals seventy ohms one wire would be the half of that or thirty-five ohms, supposing both wires to be equal; 27.29 = 78 per cent of 35, or, in other words, the ground is located at seventy-eight per cent of the length of the cable.

In this, as in the Varley test, it makes not the slightest difference what the resistance of the ground may be except to the amount of battery it may require to work the galvanometer.

THE OHMMETER LOOP—FIG. 178.

This resembles the Murray loop test, except that instead of reading the resistance in ohms it is read as a percentage of the loop length, for which purpose an extra scale is furnished that is laid on over the regular scale. The resistance of the loop L is measured in the regular way from the posts AD. Then the faulty conductor is connected to the post A and the good one to post C, while D is connected to ground, which, of course, grounds one side of the battery. The plug P is then pulled out of the ratio arm and left free. The stylus S is touched along the slide wire resistance till the point of silence is reached. The ground m on the line is now the same percentage of the length of the circuit, A, m, L, C from A, as the point of silence n, on the circuit A, n, B, C is from A. The loose scale then indicates the percentage of the fault to the length of the loop.

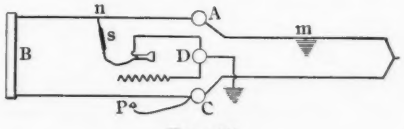


FIG. 178.

Municipal Ownership.

At the convention of the League of American Municipalities at Grand Rapids, August 27 to August 29 inclusive, Mr. James B. Cahoon, the secretary of the National Electric Light Association, made the following proposition in behalf of the National Electric Light Association, *viz.*, that they would stand one-half of the expense of a competent engineer and public accountant to the extent of $5,000 for their services; such engineer and accountant, or engineers and accountants, to be agreed upon by the presidents of the two associations—they to examine and report on the costs of any municipality operating plants that the president of the league might select, and compare the costs of the same with the published costs of a private plant of similar size and operated as nearly as may be under similar conditions as regards cost of coal, etc., so that the comparisons would be made on the basis of cost per kilowatt-hour, delivered at the lamp.

At the conclusion of the address, in which he went into the subject somewhat more fully, of course, than narrated above, laying particular stress on the subject of uniform accounting, which he informed the league had been adopted by the National Electric Light Association, and which they were at perfect liberty to apply to their plants. Mayor Smythe, of Charleston, moved that the matter be referred to the executive committee The president modified it by suggesting that the National Electric Light Association submit their proposition in writing to the executive committee through the secretary of the league, and they were to take the matter up between now and the next convention and decide on whether they would accept or reject the proposition.

Mayor Smythe stated further that he had always understood that the league was against committing themselves in one way or another in favor of or against the question of municipal ownership. The secretary of the association explained to him that their object was not to agitate this question as to the advisability or non-advisability of municipal ownership, but rather to look at it from a straight business point of view, as to whether they could operate a plant cheaper than those in the association could. If it was found that they could do so then private plants must necessarily retire from business and see investment for their capital in other directions—being only anxious to arrive at the true costs of operation of municipal plants so as to show whether private plants could, or could not, operate cheaper than they, when the proper system of costs and a uniform system of accounting were applied to both propositions.

Notes from Great Britain.

(By Our Special Correspondent.)

THE decision of the directors of the Northeastern Railway Company to invite tenders for the electrification of a small portion of its steam lines has attracted considerable attention from the engineering press. The date for the receipt of tenders, to be sent to the secretary, at York, England, is open until October 7. Four miles of four-line track, thirty-five miles of double track and some four miles of single track, the majority of which is to be utilized for passenger traffic, are to be converted, the existing track and ninety-pound rails being retained, and the latter being used for the return current. Some new substations are to be provided, the number and positions of which are left to the tenderers. Fifty motor coaches and thirty trailer coaches are asked for, and two electric locomotives for goods traffic only, the passenger trains being, of course, worked on the multiple-unit system. Six hundred and fifty volts is the working pressure and the company prefers that the working conductors or conductor shall be outside the track rails. As already stated, current is to be supplied by the Newcastle-on-Tyne Electric Supply Company at 6,000 volts, forty-cycle, three-phase, transformation taking place at the company's substations, the tenders to include all the necessary high and low-tension cables, in addition to the general electrical equipment. The directors of the Northeastern Railway Company are to be commended upon having taken this course without the preliminary skirmishing so noticeable on the part of the large British steam railway companies, and the experiment—as it assuredly is—will be followed with keen interest. A complete copy of the specifications is obtainable from the secretary of the company, at York. Strictly speaking, it is the first practical endeavor in this country to apply electricity to an existing steam railway in the open. The Inner Circle is really adapted to electric traction by reason of its being so largely in tunnel, and it is rather surprising that the freedom with which firms tendering are endowed by the terms of the specification has not been free from criticism on the part of the engineering press. Probably manufacturers will appreciate it in the spirit in which it is evidently meant.

A matter somewhat appertaining to this is the decision on the part of the Board of Trade to send Lieutenant-Colonel Yorke, chief inspector of railways under that body, on one of those beloved visits of inspection to the United States for the purpose of studying the methods of steam and electric traction there in vogue. This can not fail to be flattering to Americans, but, coming after the multiplicity of such visits on the part of various governing bodies in Great Britain, it tends to give the impression that the government itself has hitherto been very lax in these matters. It is true that Lieutenant-Colonel Yorke has already paid a similar visit to the Paris Metropolitan Railway, but having in view the large extent to which American traction practice has been followed over there, one would have thought the days of American visits at the public expense were at an end.

The Postmaster-General's report for the year 1901-1902, just issued, gives some interesting particulars concerning the Post Office telephone service. The central exchange has given every satisfaction, and some details of its equipment were given in the "Twentieth Century" number of this journal last February. Two suburban exchanges are now actually open, five more under construction, and two other important ones are in view. The report states that the demand increases with great rapidity and over 600 miles of conduits have been laid, containing 330 miles of cable, each cable averaging from 200 to over 400 wires. By the Telegraph Act of 1899, £2,000,000 was authorized to be spent upon government telephones, and up to March 31 last £972,000 had been authorized, of which the London system has absorbed nearly £800,000. No other corporations, besides Glasgow and Tunbridge Wells, have opened exchanges, although many schemes are in a forward state.

I have already announced in previous notes that some interesting trials of electrical vehicles were in process of organization by the Automobile Club of Great Britain, and in many electrical quarters these were being looked forward to as a possible stimulus to this already backward industry in Great Britain. The latest news to hand *apropos* of these trials is that up to date only two cars had been entered, both by one firm, and, as the trials were to have commenced on August 25, a postponement, if not an abandonment, has had to take place. The reason of this is hard to find. Surely it can not be that orders are so numerous as to preclude motor car manufacturers giving the necessary time to these tests? It certainly seems to be an echo of what was noticeable at the motor car show in April last.

Some speed and endurance trials of ordinary steam and petrol cars recently took place under the same auspices as those mentioned above, when an electrical timing device was utilized in the speed contests. This consisted of a watch being electrically stopped at the start of each race by the cars running over a wire. At the finish another watch, in synchronism with the first, was similarly automatically stopped. The two timekeepers then, by means of a telephone, ascertained the exact time of the race by the necessary subtraction.

A good deal has been heard over here for some time past as to the overwhelming superiority of American and Continental goods no matter in what department of trade. Perhaps a few words from "inside" will serve to demonstrate that the majority of the larger British firms can secure orders against all competition. The latest example of this kind is the placing of the £50,000 order for the generating equipment at Sydney (New South Wales), with Messrs. Dick, Kerr & Company in open competition with such foreign firms as Messrs. Brown, Boveri & Company, Messrs. J. G. White & Company and Lahmeyer & Company, besides a host of British manufacturers. All the material will be distinctly British, including, as it does, Babcock & Wilcox boilers, Ferrante engines, Tudor batteries and Dichken dynamos. The contract for the switchboard for the Bloemfontein electrical equipment has been secured by Messrs. Ferrante, and the same firm is supplying the engines for the power-house of the Cape Town tramways.

Two rather serious breakdowns have happened during the past ten days on London electric lighting mains. In Drury Lane, where mains of the Metropolitan Electric Supply Company and the Charing Cross & Strand Electricity Supply Corporation are in close proximity, an explosion occurred under very similar cir-

cumstances to those which happened on the city mains of the latter company early in the year and which were referred to at the time. In this particular case nothing more serious than slightly injuring a butcher, however, occurred. The Metropolitan company has triple concentric cables directly in the ground, while the other has "solid" cables laid in bitumen. No reason is at present assigned for explosion, but no doubt opponents of the solid system will maintain that it is due to the bituminous gas given off by these mains, as was done in the case of the city explosion. The other accident in question was of a much more serious nature, throwing, as it did, a whole metropolitan borough council, *viz.*, Islington, into darkness. This was the result of a fire in the mains running back to the main switchboard. The disaster would appear to have been aggravated by a rather old-fashioned switchboard, behind which were bunched numerous cables.

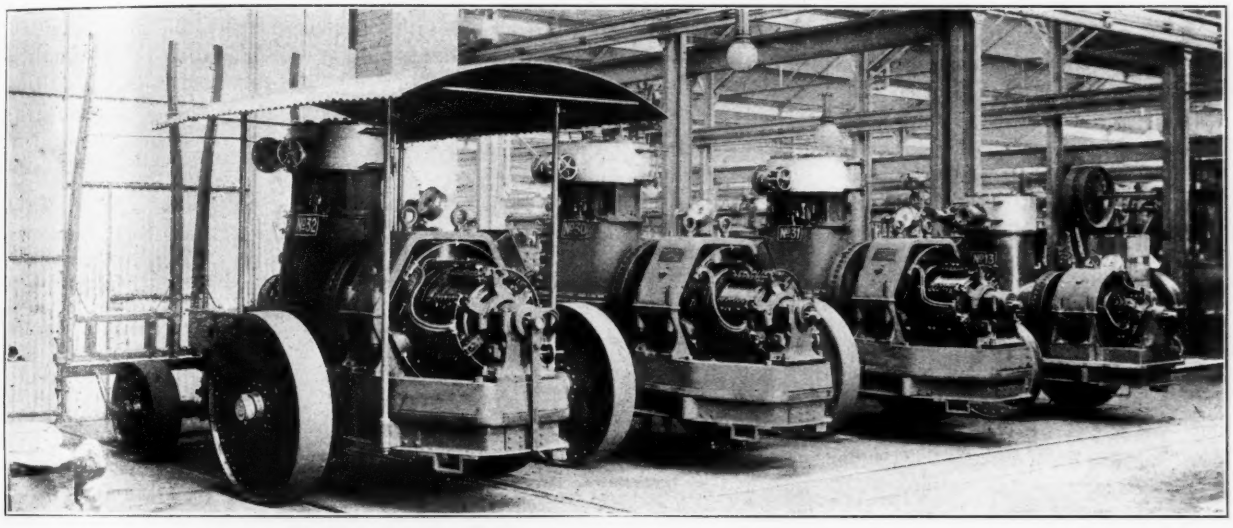
In spite of what was said to the contrary by Mr. Yerkes's engineers at the recent enquiry into electric railways by the House of Lords, it is now announced that the Liverpool Overhead Railway Company is refitting its trains with four 100-horse-power motors instead of the two hitherto used, with the object of increasing the speed from twelve and one-half to nineteen and one-half miles per hour.

The illumination of the fleet at Spithead on the occasion of the royal review, although largely spoiled by the weather, was wholly electrical, and included a five-foot spacing of lamps on hulls, masts, funnels, bridges and charthouses. The admiralty pressure is eighty volts, and no circuit contained more than forty-eight lamps. The largest number of lamps on one ship was 1,000, and 300 lamps on the smallest.

The surveys having been commenced in connection with the Manchester-Liverpool monorail railway, the construction work will be shortly proceeded with.

Some rather useful portable electric lighting machinery, a view of which is given, has recently been introduced into His Majesty's workyards, and this type is likely to be found useful elsewhere. The machines in question are necessarily small and consist of Messrs. W. H. Allen, Son & Company's (Bedford) steam engines and dynamos, having a 600-ampere output at 105 volts running at a speed of 400 revolutions per minute, the steam pressure being 110 pounds to the square inch. These sets are mounted on four wheels, with very broad treads, and are equipped for horse haulage. They are also arranged so that the complete set, minus the carriage, can be used as a permanent installation by being bolted to foundations. Covers are fitted to them when used portably, and water-proof curtains can be hung all round for protection against weather if employed in the open. Satisfactory trials have been made with this type, even for yacht service.

London, September 6. A. W.



SMALL PORTABLE ELECTRIC LIGHTING MACHINE.

Notes on Calcium Carbide Manufacture in Italy.

In Italy the calcium carbide industry is rapidly progressing, as is shown in a short communication by Mr. Cesare Pio, though it is only since last year that business in this line has become profitable. A new field has been opened by the application of calcium carbide to train lighting. A few years ago the use of acetylene was limited to small villages, but at present the number of large centres lighted with this system is continually increasing. Another field of application is the acetylene gas motor, though this has not yet been sufficiently improved to tempt many experiments with it on a commercial scale. The price of calcium carbide has been raised from $50 per ton last year to $87.50. This seems to be the result of a syndicate recently constituted on the Continent. A recent communication published by Mr. R. Memmo, who is an authority on all questions regarding the manufacture of calcium carbide, is quoted. To make the industry really remunerative in Italy the conditions must be as follows: The price of the plant per horse-power installed must not be higher than $100. A certain ratio between the number of tons of carbide produced and the number of effective horse-power produced must exist. The cost of calcium carbide, including general expenses, must not be greater than $24 per ton. Depreciation must be allowed for by a sinking fund of $8 per ton produced. The selling price of carbide must be $50 per ton, so that, including freight, loss, profits, etc., the price to customers should not be more than $60 per ton. These figures assume a profit of six per cent on the capital invested.

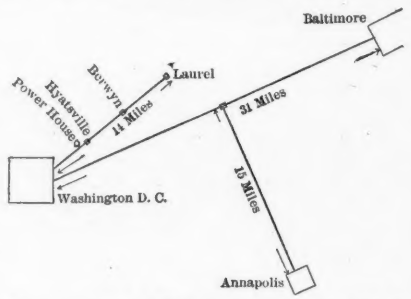
New Westinghouse Electric Traction System for the Operation of Interurban Roads.

The Westinghouse Electric and Manufacturing Company of Pittsburg has recently contracted for the equipment of an important interurban road with alternating-current apparatus throughout. The road in question is the Washington, Baltimore & Annapolis Electric Railway, which is to operate a line from Washington to Baltimore about forty miles in length, with a branch to Annapolis fifteen miles in length.

This contract marks a great step in advance that has long been awaited by engineers, both in this country and in Europe. In the ordinary method of operating street railways direct current is fed to the trolley line for the car motors. For city lines and densely populated districts, the current is often generated as direct current, but for long-distance interurban roads this would involve a cost of copper conductors entirely prohibitive. To meet the latter objection a system has been used thus far in this country involving the generation of alternating currents at high pressures of from 10,000 to 30,000 volts, and the transmission of the same to substations where, by means of transformers and rotary converters, the current is supplied to the trolley wire as direct current at the usual railway voltage from 500 to 650 volts. The rotary converter substation, however, has always been an undesirable feature, chiefly on account of the cost of the apparatus and building and the attendance required. The plans that have been proposed to do away with this feature are numerous, but before this, none has appealed to practical American street railway engineers.

In Europe the polyphase induction motor has been used to some extent, but it implies the use of two or three overhead wires, and, moreover, the characteristics of the induction motor in regard to starting and average efficiency in railway service are said to be not of the best. Other systems which have been proposed involve the use of single-phase motors upon the cars driving generators which in turn supply power to the motors on the axles. However, this involves the placing of a substation upon the car itself, and so can not be considered a great improvement over the ordinary alternating-current direct-current system. Details regarding the new system of the Westinghouse company are not at hand, but it is known that by its use the limitations of the induction motor and the disadvantages of the multiplicity of overhead conductors, as well as the great cost of the system just described, will be avoided.

For the road which is now being constructed between Washington and Baltimore, single-phase, alternating current will be generated in a main power-house located at Hyattsville, by three 1,500-kilowatt, single-phase, Westinghouse generators, delivering current at 15,000 volts and driven by cross-compound, Hamilton-Corliss engines. This station is of more than average size and is in no sense experimental. The power-house will be built of brick with stone and concrete foundations, and will contain in addition two 125-volt, direct-current generators to be used as exciters for the alternators and a large switchboard with electrically operated oil switches, circuit-breakers, lightning arresters, etc. Current will be distributed from the power-house at 15,000 volts to transformer stations located at suitable intervals along the line. These transformer stations will contain only stationary transformers with the necessary switches and fuses, but no moving machinery, and will, therefore, not require the presence of an attendant. From these stations current will be fed to the single trolley wire at 1,000 volts. The pressure of 1,000 volts which has been adopted for the trolley wire is not a necessary part of the system, as a much higher voltage could have been used if it had been deemed advisable by the engineers of the road.



ROUTE OF THE WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY.

The cars will probably be sixty feet in length and weigh about fifty tons each. They will be supplied with Master Car Builders' trucks designed for high speed, the track is laid with eighty-pound rails and it is expected that the distance of thirty-one miles will be made in forty-five minutes, including stops. The cars are to be equipped with four motors, each of 100 horse-power, and it is expected that a normal speed of forty to forty-five miles can be attained and a speed of sixty miles reached when necessary. The motor, which is the novel part of the equipment and the key to the entire system, is a variable speed motor having characteristics adapted to railway service and in all respects equal to the present direct-current railway motor. It has been developed and tested in severe service during the last few years by the Westinghouse Electric and Manufacturing Company, under the supervision of Mr. B. G. Lamme, assistant chief engineer.

As stated before, the power-house is now being erected at East Hyattsville, Md., where the railway company owns a site of three acres. The power-house will be completed in about twelve months, will be 133 x 203 feet in size and cost in the neighborhood of $350,000. It is located conveniently to water for condensing purposes and to railway facilities for handling coal, and will furnish power for the Chesapeake Beach Railroad, which is to discontinue the use of steam, and perhaps, in addition, to manufacturing plants to be located in this neighborhood.

The company is to take over a small direct-current road about fourteen miles long running from Washington to Laurel, Md., and current for this line will be furnished by two 200-kilowatt, single-phase, rotary converters located at the power-house in Hyattsville. This apparatus is also a new departure and of considerable interest, especially since it shows the possibility of operating the new system with existing direct-current plants.

It is to be remarked that this latest development in electric railroading follows in a path already traced by electric lighting. The first electric lighting systems employed direct current at low voltage, but as the area to be supplied increased, this involved a cost of copper cables. To meet the difficulty alternating-current distribution at high voltage was adopted, with rotary converter substations to enable the current to be distributed on the existing mains as direct current. However, most electric power plants now being installed distribute low-voltage alternating current directly to the lamps and motors, thus avoiding the expensive rotary-converter substations.

The engineers of the new road are the Cleveland Construction Company, of which Will Christy is president. The officers of the Washington, Baltimore & Annapolis Railway Company are W. H. Lamprecht, president, and Otto Miller, secretary, both of Cleveland, Ohio. The directors are as follows: W. H. Lamprecht, F. T. Pomeroy, F. N. Wilcox and Otto Miller, all of Cleveland, Ohio; Will Christy, of Akron, Ohio, James Christy, Jr., of Washington, D. C., and W. L. Marbury, of Baltimore, Md. It is also stated that Henry Everett, E. W. Moore and W. J. Mandelbaum & Company, of Cleveland, are largely interested in the enterprise.

HIGH-SPEED ELECTRIC CARS.

BY WALDON FAWCETT.

An effort is to be made in this country to rival the high speeds recently attained on German electric railroads, and there has lately been designed and constructed especially for this service a type of car which, by reason of the exactions which will be imposed upon it, is exceptionally interesting. The tests in question are to be made on the Aurora, Elgin & Chicago Electric Railway, a new interurban line, embracing the third-rail electrical system, which will shortly be in operation between the cities of Aurora, Batavia, Elgin, Wheaton and Chicago, Ill. Every opportunity for high speed is afforded inasmuch as the line throughout almost its entire length occupies a private right of way owned by the operating company. The only interruption in the third-rail system is at Aurora and Elgin where the tracks have been laid through public streets.

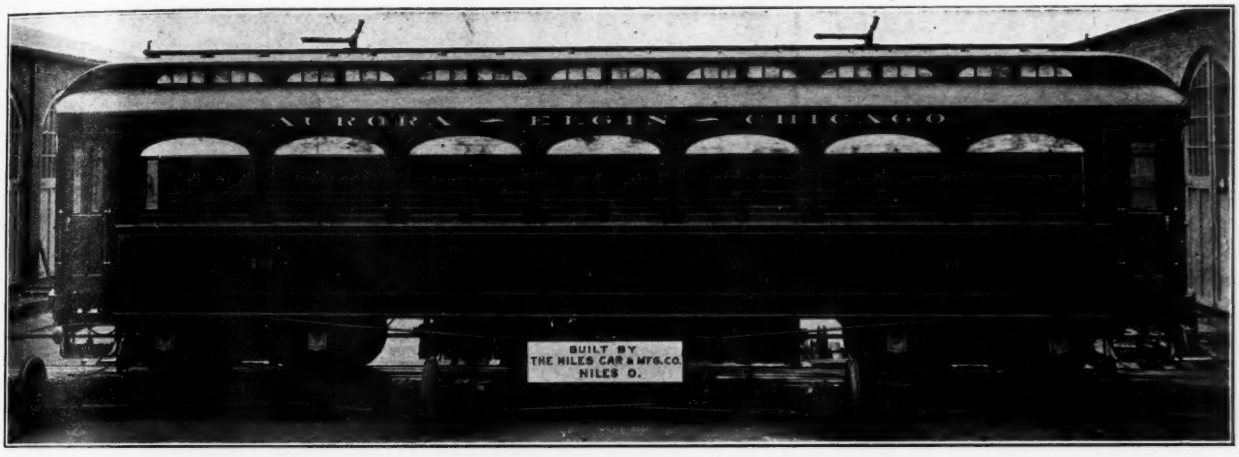
The original intention was to provide for use on this line cars capable of maintaining a speed of from sixty-five to seventy-five miles an hour, but as the electrical engineers and car builders engaged in the work of construction discovered the new possibilities opened up to them by their experiments it was decided to prepare for tests intended to disclose the greatest speed possible of attainment under reasonable conditions, and accordingly the cars have been geared up to obtain, if possible, speeds as great as 135 miles an hour.

Of course the high speeds to which the cars will be subjected and in consequence the great air pressure which they must withstand were given primal consideration in designing the cars and the claim is made that no interurban car to-day in service or under construction anywhere in the world compares in any way with the general construction of these new cars. They are built along the lines of the heaviest sleeping car designed for regular steam railroad service and are provided with cantilever framing and non-telescoping ends. The entire under framing is of steel, the iron beams and channels, plates, etc., being riveted together throughout.

The centre stringers of the car are I-beams extended entirely to the ends of the platforms, and iron and steel enter largely into the construction of the upper framing of the car. The vestibules are of what is known as the Pullman type with side vestibule doors with traps which go over the openings at the steps. These doors can be opened without raising the trap doors over the steps, so that when the cars are in elevated service passengers may step direct from the platforms at the stations into the car. The vestibules at the ends have doors which enable easy communication between the cars when coupled in a train.

The cars are mounted upon high-speed electric trucks equipped with high-speed motors of the latest approved pattern. The trucks have 6½-inch axles with 5 by 9 journal bearings. The diameter of wheel is thirty-six inches and the wheel base six feet by six inches. The weight without motors is 10,770 pounds and the weight with motors is 19,580 pounds. The cars are equipped with air brakes and with an improved air sander for sanding the tracks. Additional portable vestibules are now under construction for attachment to the vestibules proper in order to break the air pressure at high speeds. The car builders, who have designed these cars, have estimated that it is quite possible that there will be an air pressure of thirty or forty pounds per square foot when the cars are running at a speed of 110 miles per hour, so that one of the windows, two by three feet in size, would be under the necessity of sustaining a pressure of approximately 240 pounds or perhaps an even greater pressure if the cars are enabled to attain the maximum speed hoped for.

The interior architecture and ornamentation of these high-speed electric cars are suggestive of the more elaborate parlor and sleeping cars in service on the steam roads of the United States. Indeed the general design of the car is after the model of the latest type of Pullman coach with compound Gothic windows. The design of the roof interiorally is of the empire deck, modified so as not to make a heavy appearance. The finish is in quartered oak throughout and the glass is polished plate, imported. All the modern devices, such as push-buttons at each window post, are of course provided.



NEW HIGH-SPEED ELECTRIC CAR, TO BE TESTED ON THE AURORA, ELGIN & CHICAGO ELECTRIC RAILWAY.

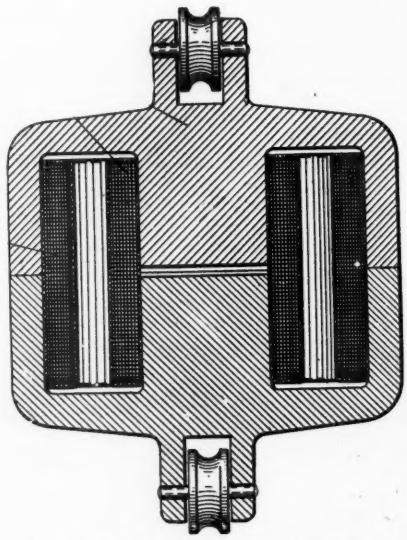
The St. Louis World's Fair will, without doubt, be the greatest and grandest exposition ever held, and the early action by the American Electrotherapeutic Association can not be too highly commended. It will undoubtedly result in greatly assisting the universal dissemination of the knowledge of the value of electrotherapeutic methods by stimulating activity in the production of exhibits that will have a distinct educational value.

It is high time that a more general appreciation should obtain of the great good that can be done by the proper and scientific use of electricity in the treatment of disease, and it is very gratifying to know of the progressive and strenuous efforts that are being put forth by the exposition to afford every facility for the building up of this joint branch of electricity and therapeutics on broad and highly scientific lines.

Electrical Patents

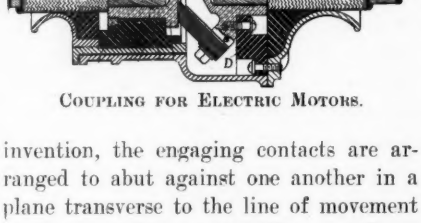
Mr. Richard Fleming, of Swampscott, Mass., has invented a modification in electric arc lamps, and the General Electric Company has obtained the patent for the same. The object of the invention is to enable the reactance coil to be placed in or close to the upper part of the lamp-casing instead of at a distance from the lamp. By this invention the coil can be located just above or in the upper part of the lamp-casing, like the ordinary resistance coils. The result is accomplished by enclosing the reactance coil in a magnetic casing or cage with a central core provided with an air-gap. The coil is designed to be placed just above the lamp-casing. The frame of the coil consists of a magnetic cage composed of two similar parts joined at the middle and held together by screws. Each part is composed of an open-work structure, preferably a ring, from which rise arms, the upper ends of which turn radially inward and unite in a central hub, from which a core projects toward the middle plane on which the two parts join. The opposing inner ends of the two cores do not touch, an air-gap being left between them. An insulating suspension ring is attached to each part at the hub, the upper one serving to suspend the coil and the lower one the lamp proper. The reactance coil is preferably made in two annular sections, one of greater diameter than the other. The smaller one fits closely to the cores, while the larger one fits closely inside the arms, an annular space being left between them for ventilation, which is assisted by the open spaces between the arms. Any other equivalent mode of constructing and arranging these parts to accomplish the desired ends may be employed if desired. In case the coil is to be placed in the upper end of the lamp the lower part of the cage may have a central hub to receive the upper end of the tubular backbone of the lamp, which may be secured therein in any suitable manner.

The General Electric Company has also obtained control of a patent on a coupling for electric motors devised by Frank E. Case, of Schenectady, N. Y. This invention relates to couplings for connecting electric conductors, especially those employed in transmitting electric currents through the several cars of a railway train. Such conductors must be provided with detachable couplings at the ends of each car, and if the conductor is to carry a heavy current, such as that used in operating electric railway motors, the contacts must be exceptionally good and yet be capable of quick connection and ready separation. They must also uncouple automatically when the cars accidently pull apart. The invention aims



Modification in Electric Arc Lamp.

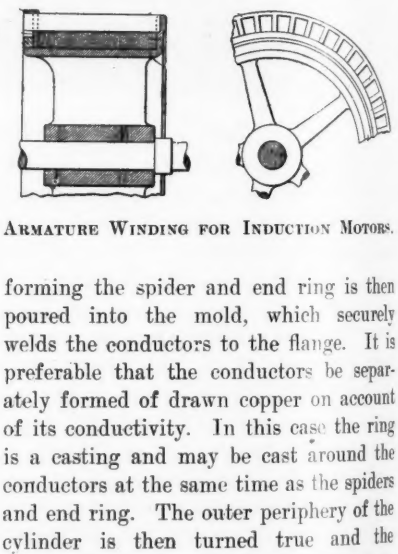
to accomplish all these ends by a strong and comparatively inexpensive construction. The coupling comprises a fixed member adapted to be mounted beneath the car platform at the end of the car and a removable member constituting one of the terminals of a "jumper," by means of which connection is made from one car to another. The two members of the coupling are provided with engaging contacts suitably insulated from their enclosing casings, and a locking device constructed to yield under an abnormal pull, such as would occur when the train breaks apart, is provided for normally holding the two members together, with their contacts in engagement. According to the present



Coupling for Electric Motors.

invention, the engaging contacts are arranged to abut against one another in a plane transverse to the line of movement of the removable member. They can therefore be forced into close electrical contact with no danger of their sticking together when an attempt is made to separate them. In this construction the contacts of the two members of the coupling are forced into close engagement by means of a locking device provided with cam surfaces. In order to make the contact as perfect as possible, the contact in one of the members is in the shape of one or more brushes constructed of sheet copper or other suitable material. By mounting such brushes at an angle to the line of movement of the movable member of the coupling the resilience of the metal is made use of in maintaining the contact.

Mr. Albert H. Armstrong, of Schenectady, N. Y., has patented an armature-winding which will stand overheating up to the melting point of copper without being destroyed. To this end he mounts on the shaft a spider comprising a hub and a number of radial arms connected at their outer ends to a cylinder which forms a support for laminæ. Formed integral with and at right angles to the cylinder is a flange. The conductors extend parallel to the shaft and are connected at their opposite ends by rings cast or otherwise formed integral with the conductors instead of by soldering or riveting as has heretofore been done. One method of constructing the armature is to prepare a mold in the usual manner and place conductors in a circle at suitable intervals in the sand. The molten metal

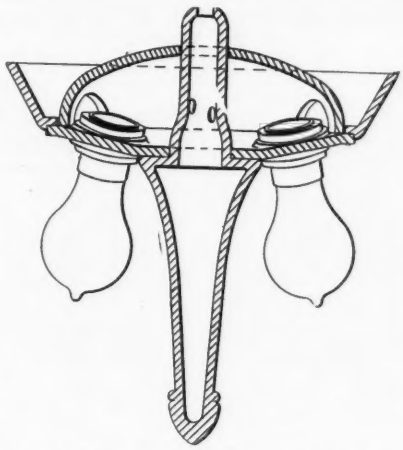


Armature Winding for Induction Motors.

forming the spider and end ring is then poured into the mold, which securely welds the conductors to the flange. It is preferable that the conductors be separately formed of drawn copper on account of its conductivity. In this case the ring is a casting and may be cast around the conductors at the same time as the spiders and end ring. The outer periphery of the cylinder is then turned true and the toothed laminated punchings slipped into place. The laminæ are provided with teeth which occupy the space between adjacent conductors. The outer diameter of the teeth is such that they will pass under the ring, and the slots in the laminæ are deep enough to receive the conductors. After the proper number of laminæ have been assembled the end ring is mounted in position and a clamping ring is employed to retain the end ring and laminæ in place.

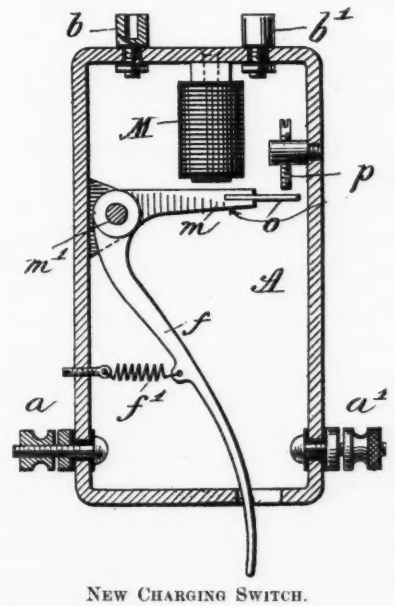
An Englishman, Mr. Clarence M.

Stead, residing in Leeds, England, has patented in this country a novel electric lamp support, his object being to construct a device of this character from a small number of parts of such simple shapes that they can be readily made in porcelain, glazed earthenware, and the like, and be fitted and suspended together without any metallic connections, save only the usual holders and collars for the lamps themselves. To this end there is employed a pendent piece forming a reflector within the cluster of lamps and having an upstanding shank at its upper end. A combined reflector and supporting plate is mounted upon this shank and has suitable lamp-receiving sockets. A cap-piece forms the third element and is also attached to the shank, constituting a cover and protection for the wire connections.



NOVEL INCANDESCENT LAMP HOLDER.

Mr. Miller R. Hutchison, of New York city, has assigned to the Hutchison Acoustic Company of New Jersey a patent on a new charging switch. This invention is a device by which unskilled persons can conveniently connect a storage battery with a source of electricity in the proper manner for charging. It is well understood that the poles of the charging circuit must be connected with the poles of the battery in such a manner that the current will flow through the battery in a direction contrary to the direction of discharge, and while persons skilled in the handling of such apparatus are familiar with appliances and means for accomplishing this charging process properly; persons unskilled, who find it necessary to use storage batteries, must be provided with ready and convenient devices for charging which will prevent injury to the battery. The device embodies a polarized electromagnet, a switch controlled thereby, and suitable means for connecting with the source of current and the battery. The switch mechanism is enclosed in a suitable casing A, provided externally with two binding-posts *a* and *a'* for connecting the terminals of the battery. It is also provided with two sockets *b* and *b'*, into which plugs connecting with the charging circuit may be inserted. Inside of the casing is fixed an electromagnet M, whose armature *m* is polarized, and therefore responsive only when current of a certain polarity flows through the magnet. The armature carries a contact finger *o*, adapted to connect with a contact *p* when the magnet attracts the armature. With the armature is also connected a lever or arm *f*, which extends through a slot in the box a short distance, so that its position may be seen. A spring *f'* acts upon the lever in a way to withdraw the armature from the contact *p*. The pivotal point for the armature lever *f* is at *m'*. The projecting end of the lever *f* serves as an indicator to show the condition of the contacts *o* and *p* with respect to each other. The circuits will be described in connection with the operation, which is as follows: When the battery is to be charged, plugs *g g'* on the end of a flexible cord, one of which is larger than the other, are inserted into or connected with the terminals of the battery B, which they



NEW CHARGING SWITCH.

respectively fit. The other two ends of the cord are then connected with the binding-posts *a* and *a'*. Then the two plugs *h* and *h'*, connected, respectively, with the two sides of the charging circuit, are inserted into the sockets *b* and *b'*. A circuit is then established through the battery as follows: From one side of the main circuit to the socket *b*, thence by wire 1 through magnet M to the contact *p*. From the armature *m* a wire 2 leads to binding-post *a'*. Thence the circuit leads through the cord and the battery and again through the cord to the binding-post *a*. From *a* a wire 4 leads to the socket *b'*. The operator then moves the lever *f* a full stroke to the right, whereupon the circuit is completed between the contacts *o* and *p*. If the current is flowing in the right direction for charging the battery, the magnet will hold the contacts *o* and *p* together and the lever *f* will remain to the right and the battery will charge until the circuit is broken by moving the lever to the left or by separating any of the connections. If on moving the lever to the right in the first instance it was not retained in that position, but was immediately retracted to the left-hand position by the spring *f'*, the operator would know that the current was flowing in the wrong direction to charge the battery, and he will then reverse the position of the plugs *h h'* in the sockets *b b'*. This reverses the direction of the current, and the battery will be properly charged.

The stock of copper on hand in the United States on January 1, 1902, is estimated as being at least 300,000,000 pounds, equivalent to six months' production. In the absence of figures which might be said to represent normal years, it is impossible to do more than make a guess at what might be considered the excess over a reasonable stock. It is probably fair to assume that, even at the beginning of the year 1901, the stocks of copper in this country were beyond the working limit.

The copper market opened in 1901 rather dull at the official prices of 17 cents for Lake and 16½ cents for electrolytic, but actual sales were made at 16⅞ cents for Lake, and at 16¼ cents for electrolytic. By January 13, 1902, the official prices had fallen to 11⅛ cents for Lake copper.

The world's production of copper in 1901 was 511,803 long tons, as against 487,206 tons in 1900, 463,693 tons in 1899, and 429,379 tons in 1898.

By far the most important of the new mines which have entered the world's market in recent years is that of the Greene Consolidated Copper Company, whose properties are located at Cananea, Sonora, Mexico. There is every reason to believe that, before the close of the current year, the production of this company will reach 4,500,000 to 5,000,000 pounds of fine copper per month. Such a rapid development has never before been witnessed in the copper-mining industry.

Reviews of Current Engineering and Scientific Literature.

Giving Concisely the Substance of Important Papers in the Scientific, Electrical and Engineering Press of the World.

Earthing the Middle Wire in Three-Wire Distributing Systems and Distribution with Uninsulated Neutral.

The first of these two contributions is by Mr. G. Hooghwinkel, and favors the use of an earthed neutral in three-wire distributing systems. This is almost universally the case on the Continent, and is often specified by local authorities in Germany. It is the practice in England to make the section of the neutral conductor fifty per cent of that of the others, while on the Continent it is but twenty-five per cent, and this is easily proved to be sufficient with a grounded neutral and effects a considerable reduction in cost. The advantages of a bare neutral are: Greater reliability of working, cheapness of distributing mains, cheaper and easier house-service connection and facility in laying distributing cables on both sides of the street. The allowable loss of volts in the middle wire over its entire length is taken as three volts, and no danger to gas or water pipes or telephonic disturbances is possible under these conditions. Insulation faults mostly arise from houses, but if the bare metal wire is used in the distributing system, these faults become less troublesome. As a house fuse in a respective outer is blown, before the light can again be set right, the faults must be remedied. Thus, an uninsulated middle wire is more reliable, as faults in an outer will not remain unlocated. There should be no fuses in the middle wire, neither at the station nor in houses. The same point is made by Mr. E. Morgan in the second of the above contributions. As the neutral wire is grounded at all points, there can be no faults in this main, and this at once clears away half the troubles. Faults will be easily located, as a bad leak will suffice to blow in a distributing circuit, while a small leak would not entail stoppage of supply. The author advocates the use of a concentric cable, of which the lead sheathing forms the uninsulated neutral. He finally recommends the following system of distribution: Three-phase current distributed by three-core cables, lead-covered, the lead being used as the earthed neutral, and being connected to all junction boxes and services taken off by lead-wiped joints.—*Electrical Review* (London), August 29.

Wireless Telegraphy.

In a lecture delivered before the Association of Ingénieurs Electriciens, Mr. O. De Bast explained the theory of the action of the coherer as developed by Mr. S. Fernandez-Gimenez. Given two bodies isolated in space, a charge imparted to one will induce an equal, but opposite, charge on the second, if the latter be connected to the earth, the two forming a condenser. If there are in the neighborhood of the two bodies other bodies also connected to the earth, some of the lines of force set up by the charged body will pass to these. In all cases, however, the sum of the induced charges will be equal to that on the first body. If there are in the neighborhood of the system bodies not connected to the earth, these will simply cause a deflection of the lines of force, without reducing the induced charge. If the charge is an alternating one, the induced charge will also be alternating. If, now, in the earthing connection of the plate upon which the charge is induced a condenser of small capacity is introduced the potential across this may be sufficient to cause its two charges to reunite across a suitable spark-gap. If the induced charge is small the capacity of this condenser must also be small, but it can always be made so by connecting a sufficient number of condensers in series. The discharge of these condensers will be oscillatory, but the period will be independent of that of the inducing charge. A coherer may be considered as a group of very small condensers arranged in series parallel, each pair of particles being separated by a thin coating of oxide, and forming opposite sides of an elementary condenser, the capacity of the whole being very small. The two antennæ may be considered as the opposite plates of a primary condenser. If a coherer is connected in series with the receiving antenna, and this latter be charged by induction, the difference of potential across the coherer may be sufficient to cause a spark to pass. In this case, however, the spark passes from particle to particle, tearing off at each gap a small part of the oxide coating, and bringing the particles into metallic contact. This action allows the current to flow in a suitably arranged local circuit. A slight tap on the coherer displaces the particles, breaking the metallic connection. Experimental researches based upon this theory seem to verify it. In this study the antennæ are considered as two sides of a static condenser, and the coherer as a means of obtaining considerable difference of potential, as well as an instrument for indicating this. The induction coil at the transmitting station enables an alternating charge to be imparted to one side of the condenser.—*Bulletin des Ingénieurs Electriciens* (Paris), August 14.

Windings of Continuous-Current Dynamos.

In the second section of his paper on this subject Mr. E. J. Brunswick discusses Arnold's theory of winding and the use of equipotential connections. Given an armature quite symmetrical mechanically and electrically, points can be found having the same potential, and these may be connected together. In the operation of such a machine these connections play no part and carry no current. Should, however, any dissymmetry exist currents will flow through these equipotential connections. If the equipotential connections are properly established, a complete circuit exists in which the electrical forces are equal and opposite. To secure this condition, it is necessary that the number of sections of the accumulator be divisible by the armature sections having the same potential. The author then discusses the various types of winding, taking up the spiral or Gramme ring first, and it is shown that the distance between points at the same potential is equal to twice the polar span. In considering a series of parallel windings, it has been found advantageous to use a reduced scheme or diagram which can be represented by a much simpler diagram than can the actual winding. This scheme is developed in the following way: Considering

two conductors connected in a series in a wave winding, these will necessarily lie under the poles having opposite polarity. For either of these conductors there will exist an exactly symmetrical position under the same pole as the other. The electromotive forces set up by these conductors in these two positions will be equal at all times but of opposite sign. Now the electromotive forces of the armature will not be affected if one of these conductors be moved to its symmetrical position, and be so connected to the first as to maintain the same relations. Since with a wave winding the rear ends of the two conductors are connected together, in the reduced scheme, the front end of one must be connected to the back of the other, the other two ends being carried to the commutator. A consideration of this arrangement will show that the reduced scheme produces a simple ring winding. Various types of winding are considered by means of this scheme and the different rules for each clearly developed. Although with the wave winding the number of bifurcations of current need not be the same as the number of pairs of poles, in the reduced scheme this is necessary and the diagram will be modified accordingly. In multiple windings no difficulty is met with in applying this method. Windings with unequal front and back spacings are considered, and the proper rules for laying them out developed. A table of tabular arrangement is then described for easily changing from the reduced scheme to the actual one. This has been in use for some time and has proved entirely satisfactory.—*L'Electricien* (Paris), July 26.

Electromotive Waves Accompanying Mechanical Disturbance in Metals in Contact with Electrolyte.

In this serial Professor J. Chunder Rose gives a detailed discussion of his investigation of the electromotive forces produced by mechanical disturbance in metals in contact with electrolytes. When a rod of metal is connected to a galvanometer, by means of an electrolyte and non-polarizable electrodes, any mechanical disturbances of the metal will cause electromotive forces to be set up at the points of contact with the electrolyte. The method of experimenting consists in attaching to a metal rod two loose cloths, which dip into cells containing any suitable electrolyte. The circuit is completed between the two cells through a galvanometer by means of two electrodes. When this rod is set in vibration, either due to a blow or torsion, the electromotive forces are set up at the two points of contact with the electrolyte and will, in general, be the same, and there will be no indication by the galvanometer. To make the effect apparent it is only necessary to damp the vibrations at either end of the rod. This can be done by a suitable clamp. Under these conditions a vibration of the free end will be set up, an electromotive force and a current will flow through the rod toward the agitated point. The fact is the same whether the vibration be caused by torsion or simple bending of the rod. The shifting of the clamp from the fixed end to the other end, and stimulation of the now free end, will cause a reversal of the above phenomenon. The effect is proportional to the amplitude of vibration, as can be shown by clamping the rod in the centre and causing unequal vibration of the two ends. Current in this case flows toward the end where the vibration is greatest. If the clamp be placed unsymmetrically with respect to the two ends, but the amplitude of vibration be the same, the effect will be maximum at the shorter end. Increased excitability is produced by preliminary vibration. Thus, if one end be set in vibration and then allowed to come to rest, and the two ends be equally excited, the effect at the previously vibrated end will be the greater. While some chemical reagents are normal in their action— that is to say, the stimulation is practically the same as with distilled water—there are others which cause an increased excitability; and, on the contrary, others produce a depression. The author then discusses the method of studying these effects by so moving the clamp on the rod as to produce a balance. He then describes a cell which has been found convenient in these researches. The previous history of the metal, or, in fact, anything which produces a physical modification of the metal, will cause the effect to vary. Thus, annealing a wire increases its excitability.—*The Electrician* (London), August 29.

The Station Transformer Hazard.

The hazards of converters are those of dynamos or motors, which are well understood and under easy control; but those of transformers may well be made the subject of long and patient investigation. This is done by Mr. George P. Low, and his conclusions presented in a paper before the annual convention of the Fire Underwriters' Association of the Pacific. After a preliminary discussion of the construction and operation of transformers, he takes up the subject proper. The rapid increase in transmission voltages—which until eight years ago was 10,000 volts and to-day is 40,000, while 80,000 has been used experimentally—makes it necessary that something more than the insulation of fibrous materials should be used in transformers, and the practice of immersion of the transformer in oil has come into vogue. The selection of oil should be made with the greatest possible care, for it is essential to the welfare of the transformer that it should be free from acids, mineral compounds or anything which could possibly exercise a deleterious influence upon the transformer. If incipient trouble develops in the transformer, this oil rushes in and heals the wound. Under normal conditions, therefore, the use of oil is a necessity of the greatest possible good, and it is only under exceptional conditions that its presence involves danger. Heat is always developed by a transformer when it is in action, and this is taken up by the oil and delivered to the surface of the transformer face, or to water pipes, as the case may be. This rise in temperature is usually limited to forty degrees centigrade above that of the surrounding air. If, however, a short-circuit occurs, the temperature of the oil may be raised to the boiling point. If the burnout and arcing occur with explosive violence, oil will be blown out of the case and scattered about the premises. Oil itself will not burn under ordinary conditions as to temperature and confinement, but when at the boiling point, and scattered in all directions in this heated state, there is great danger. Fortunately, breakdowns of this kind are extremely rare. The hazard of the modern power-house has been so reduced that the hazard of a transformer is great only in comparison with it. But one weakness is recognized in transformer manufacture, and that is the use of sheet-iron casings, which in the event of fire or particular station trouble are usually broken, or torn, or punctured so as to release the oil and allow it to flow out. The casings should be of the most substantial and durable kind. The real hazard of a transformer is that due to storage of a very high-grade oil, which in rare cases may be scattered and ignited. The elimination of this hazard would be best accomplished by the confinement of transformers in separate fireproof buildings, but whether it is always necessary to resort to this final expedient is a matter of great doubt.—*Journal of Electricity, Power and Gas* (San Francisco), August.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

Automatic Injectors.

With the advance of steam engineering and the perfection of all the details, it has been demonstrated that a perfect injector can be profitably used as a boiler feeder.

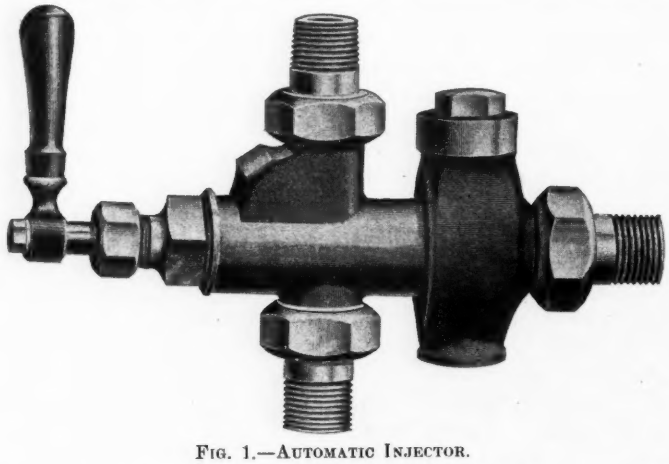


FIG. 1.—AUTOMATIC INJECTOR.

To secure the best results, the conditions under which the injector is to be used should be carefully studied, and a type of injector selected most suitable to meet the requirements. The adaptation of steam to commercial purposes presents such a varied change of conditions of steam pressures, source of water supply and general service, that it might be found practicable to use two types of injectors—the automatic, or open overflow, and the double-tube, or closed overflow, each type possessing its peculiar advantages which makes it especially adaptable for varied conditions.

The Metropolitan automatic injector, shown in Fig. 1, was designed with the view of supplying an automatic injector complete in itself. This injector is operated entirely by one handle, and does not require the manipulation of globe valves in the steam and suction pipe. The tubes are removed by the use of an ordinary monkey-wrench, no special tool being required. The overflow valve can easily be ground to its seat with an ordinary screw-driver. The injector lifts the water promptly, and as soon as it is lifted it is promptly discharged into the boiler without waste at the overflow. It is claimed to be reliable under all conditions, and will feed steadily without adjustment. The construction is of special composition, very hard, making it very durable. The tubes are of special mixture, to resist wear. All the parts are interchangeable, and any part becoming worn or damaged can easily be replaced. The range of all automatic injectors is dependent upon the steam jet, the opening between the steam jet and suction jet being a vital point. It is possible, with a fixed opening, to obtain without adjustment a range from seventy to seventy-five pounds of steam pressure. Consequently, if this opening is fixed, and such that the injector will work as high as 145 pounds, when the steam pressure falls below seventy or seventy-five pounds, all or a part of the water will run out of the overflow unless a valve in the suction pipe is adjusted for each variation of steam pressure. To overcome the necessity of this adjustment, a sliding steam jet having two metal seats is used. By the use of this arrangement, the Metropolitan automatic injector has a range of from 125 to 135 pounds.

Fig. 2 shows the Metropolitan double-tube injector. This is provided with two sets of tubes. One set is proportioned for lifting, which constantly lifts the water and delivers it into the forcing set of tubes, which in turn forces the water into the boiler. The lifting set of tubes acts as a governor to the forcing set, supplying under a great range of steam pressure the proper amount of water to condense the steam in the forcing apparatus. Owing to the positive closing overflow valve in the delivery chamber of the forcing apparatus, the forcing combining tube can be made solid without any relief holes or spills. By the use of this kind of tube, together with the principle of the lifting tubes acting as a governor to the forcing tubes, the double-tube injector is capable of delivering water into the boiler as high as 300 degrees Fahrenheit. This injector can be successfully used when the water supply is hot or on long lifts, with very low and very high steam pressures, and does not require any adjustment whatever when working at the lowest or highest steam pressures on a long or short lift with hot or cold water. Under all conditions the operation is the same. The double-tube injector is used extensively for large stationary plants, marine and locomotive use, and for all places where the conditions are too severe for the automatic injector. These injectors are made by the Hayden & Derby Manufacturing Company, New York city.

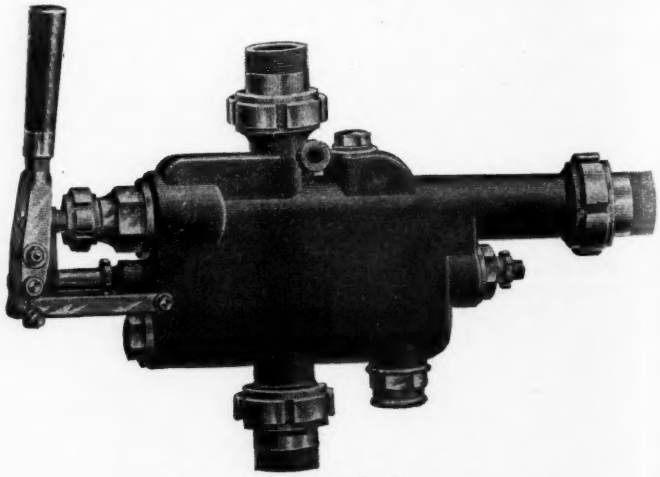


FIG. 2.—DOUBLE-TUBE INJECTOR.

A New Electric Hoist.

Various attempts have been made to design an electric hoist capable of handling heavier loads than come within the range of hand hoists, and not requiring the heavy and expensive supporting structures necessary to carry the large amount of dead weight of ordinary traveling cranes.

The Sprague Electric Company, New York city, has produced and placed on the market a machine of this character which will stand the use and abuse to which all such apparatus is subjected, that would effectually fulfill the requirements of modern shop practice, and be commercially practical.

This hoist, as shown in the accompanying illustration, fulfills all these requirements, and is protected by patents owned by the Sprague Electric Company.

It is designed to transfer light work rapidly around shipyards, factories, etc., and when supplied with trolley carriage, geared hand, cross-travel and bridge-travel motor, to take the place of small traveling cranes.

This hoist has many advantages, and is a new system of motor control for electric hoists and has a high efficiency.

It consists of few parts, all of which are interchangeable. It is easily adaptable to all types of runways and bridges, and the sides range in maximum capacities from 1,500 pounds to 10,000 pounds.

The smaller sizes can be equipped with a trolley arranged to run on a single rail or I-beam, and, if so arranged, will take curves of a reasonably small radius.

In designing this apparatus, the manufacturer has carefully kept in view the fact that it would be subjected to rough usage. All parts are made of great solidity and of the highest grade material, and all bearings have been made self-oiling, requiring but trifling attention at long intervals.

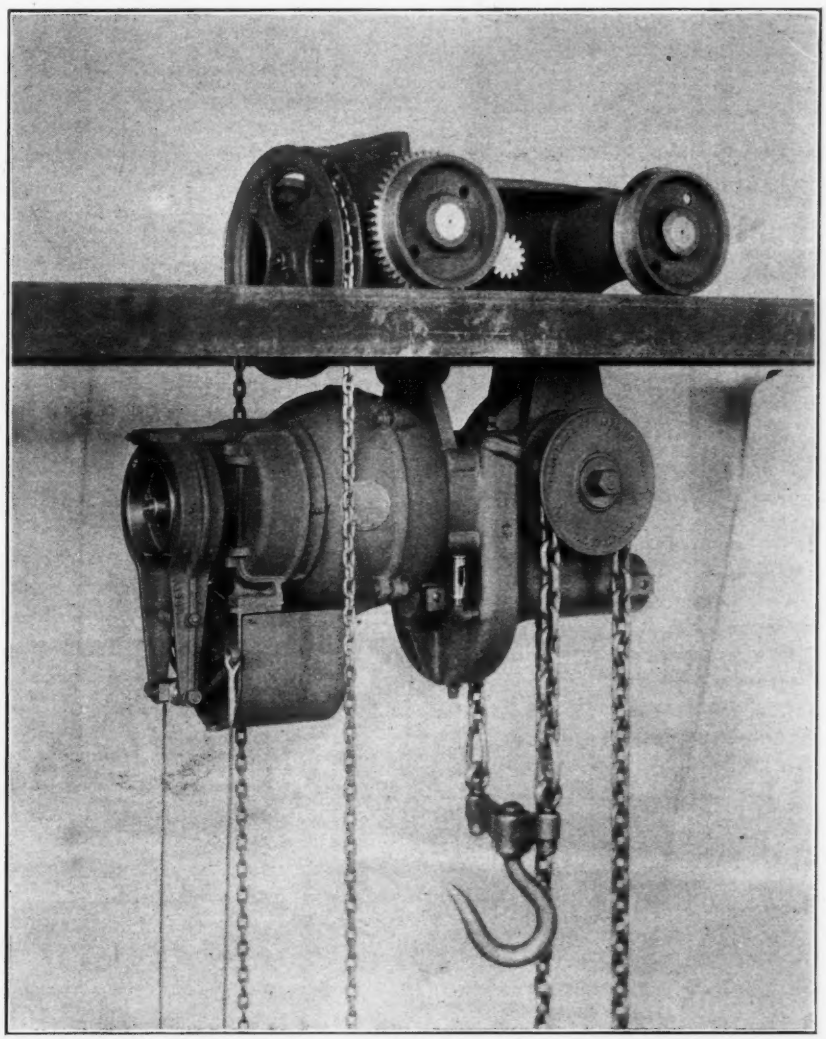
All the different movements necessary for a traveling crane, namely, hoisting, lowering, cross-travel and bridge-travel, are controlled by a simple pulling of the chains and cords connected to the mechanism, and which can be operated by the ordinary workman to be found in the machine shop, factory or other place where the hoist may be used. This is a unique feature to which special attention is called. No special crane operator or cage is necessary.

The motor and hoisting mechanism can be hung from a strap if only a hoisting and lowering motion is desired, or it can be attached to a trolley carriage arranged for cross-travel, either by pushing the lead, or by a geared-hand traverse motion. A bridge-travel is also provided, the controller for which is mounted on the end of the trolley carriage, as shown in cut. This controller is operated by cords, the handles of which are located near the work. The bridge-travel motor itself is mounted in some convenient position on the crane. The bridge-travel motion is reversible, and in practice it is possible to obtain a very short movement in either direction.

The motors furnished with this equipment are the Sprague company's round-type motors, entirely enclosed, and the hoist can be operated out of doors without being affected by the weather. The resistance plates for the bridge-travel controller are of the enclosed type, and have a very large overload capacity.

The Sprague Electric Company manufactures and furnishes the complete hoist as shown, consisting of hoist wheels and chain, worm and spur gear, gear cases, hoisting motor and attached cylindrical switch, trolley carriage, geared hand-operated cross-travel of trolley carriage, and motor and controller for bridge travel of crane.

The hoist and motor can also be furnished complete without trolley carriage or with trolley carriage gear hand cross-travel, but without bridge-travel motor and controller.



ELECTRIC HOIST DESIGNED FOR THE RAPID TRANSFER OF LIGHT LOADS.

The total imports of copper in the United States in 1901, from all sources and in all forms, amounted to 124,938,323 pounds, as compared with 103,895,026 pounds in 1900, with 93,172,191 pounds in 1899, and with 50,268,499 pounds in 1898.

The total value of the exports of copper from the United States in 1901 was $36,071,448, as compared with $58,875,439 in 1900, with $43,485,654 in 1899, and with $35,545,251 in 1898. Germany is by far our largest customer for copper, since the greater part of the metal shipped to the Netherlands is in transit for that country; on the other hand, some of the copper which goes to the United Kingdom is shipped from there to other countries. The details of these movements can not well be followed.

The estimated consumption of copper in the United States in 1901 was 382,761,014 pounds, as against 356,891,121 pounds in 1900.

Automatic Telephone Apparatus.

On January 1, 1902, the Automatic Electric Company, Chicago, Ill., purchased the factory of the Strowger Automatic Telephone Exchange, and acquired the sole manufacturing and selling rights in the United States of automatic telephone apparatus fashioned after the latter company's patents. The accompanying illustrations show some of the parts as used in this company's system, which it is claimed gives the advantage of quick connections, instantaneous disconnections, prompt answers secured from the called subscribers, and accuracy and promptness with which a busy signal is always given when a subscriber is actually busy.

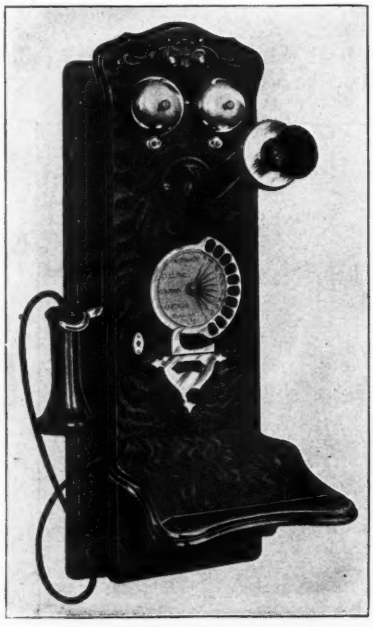


FIG. 1.—WALL TELEPHONE.

The automatic telephone consists of the usual transmitter, receiver, bells, battery and induction coil, with the addition of a selector-calling apparatus, which occupies a space of five by three by two inches just above the battery, or about two-thirds of the space occupied by the ordinary magneto generator. On the front of the box is the metal-calling dial, three and one-half inches in diameter. On the right side of this dial, along the edges, are ten finger holes numbered consecutively from 1 to 0. A stop is provided at the lower of the holes to limit the distance which the dial may revolve. Fig. 1 shows a wall telephone.

To call a number, say, 761, the subscriber first takes the receiver from the hook, then placing his finger in the hole No. 7, turns it around to the stop. When released, the dial instantaneously returns to its original position. The subscriber is now connected to a trunk line leading to a group of switches which is called the seventh hundred group. In the same manner he then calls six and one in this group. Having turned to the consecutive number desired, he presses a button which rings the bell of the person wanted, and the connection is completed. One second or less for each decimal is the time required. In the event that the desired subscriber is busy, a buzzing sound in the receiver notifies the caller that such is the case. The wall telephone shown in Fig. 1 is ordinarily made of polished oak, but any finish can be given that may be desired. This instrument is twenty-two inches in height, seven and one-half inches in breadth, and five inches in depth.

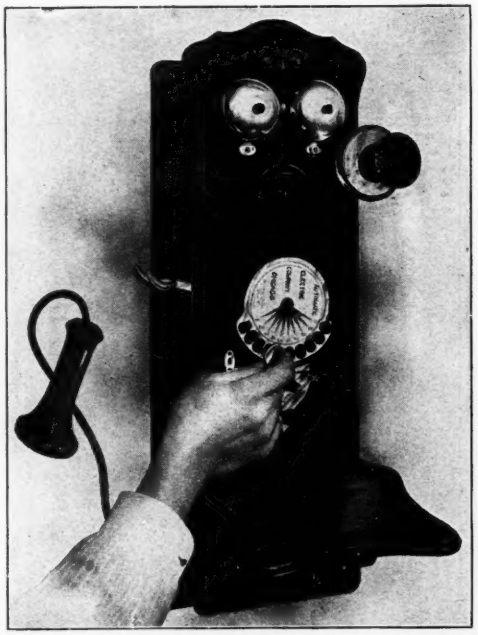


FIG. 2.—REVOLVING THE DIAL, MAKING A CALL.

It is equipped with the regular receiver and transmitter.

Fig. 2 shows the wall telephone with the receiver off the hook. The hand is revolving the dial in the act of making a call, the figure five having been turned around to the stop.

Fig. 3 shows the interior of the wall telephone with the receiver on the hook. The ringer, dry cells, induction coil and calling mechanism make up the contents of the telephone. All the springs are made of German silver, and platinum rivet contacts are used.

Fig. 4 shows a desk telephone equipment, the case and pedestal of which are of drawn brass highly nickeled. The front and rear caps of the case are removable, so that the calling mechanism can be easily and quickly inspected without disconnecting a wire. The induction coil is mounted in the base of the pedestal. The platinum connections and hook springs are carefully protected, and the calling device is similar to that of the wall telephones, but somewhat modified in shape. The desk set is twelve inches in height and has been very carefully and attractively designed.

Fig. 5 shows the keyboard and dial, with receiver arm, the operation of which has already been explained. This is one of the most interesting features of the automatic system, and to bring it to the state of perfection which it has now reached has required the untiring efforts of electrical and mechanical experts. The manufacturer claims that these labors have been rewarded by the accuracy, ease and rapidity with which it operates, as well as by the remarkable life which each part has shown when subjected to the most extraordinary tests.

For special office use, where the regular desk telephone is not desired, a pedestal telephone designed to stand at the side of a desk or table, or between two desks, is made. The transmitter arm places the receiver at the proper height to be used by one sitting, and the batteries are placed on the pedestal, calling dial, transmitter, receiver, keyboard and induction coil forming the superstructure. The transmitter is suitable for either local or long-distance work. Instead of a solid back holding the back carbon, a cup formed from No. 9 steel is used. The front cap

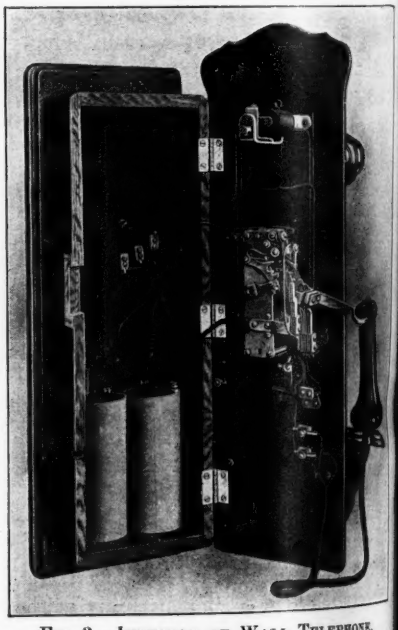


FIG. 3.—INTERIOR OF WALL TELEPHONE.

is formed from No. 9 brass. The arm is formed of steel made in two pieces, the base being formed from steel. In assembling these two, the metal diaphragm is placed in the cup. The back cup is then screwed into the cap, after which the arm is screwed into the cap covering the cup. This method of building a transmitter is simple, and makes it an easy matter for the inspector to open and repair it in the event of this becoming necessary. The receiver shell is made of the best hard rubber, with removable cap. This is of the regular double-pole type, with concealed terminals, the permanent magnet cells and electromagnets being firmly mounted in a brass cup, which is in turn held firmly in place by the receiver cap.

The core of the induction coil, which is very heavy, is made of soft Norway iron three-eighths of an inch in thickness. The primary is wound to one-fifth of an ohm, and the secondary is wound to fifty ohms. The primary is wound with No. 19 single-cotton wire, and the secondary with No. 29 silk-magnet wire. After being made up, the magnet is thoroughly saturated with beeswax. These coils, after being subjected to the most rigorous tests in various exchanges, are claimed to have given remarkable satisfaction.

The adjustment of the ringer is exceedingly simple. The armature is moved to or from the coils by loosening a screw in the centre of the permanent magnet which secures the movable back on which the armature is mounted. By turning the set screw at the end of the permanent magnet, the armature can be quickly adjusted as desired.

FIG. 4.—AUTOMATIC DESK EQUIPMENT.

Figs. 6, 7 and 8 are, respectively, the front, side and rear views of the switch. This automatic switch is thirteen inches in height, four and one-half inches in depth, and four inches in breadth. The upper half consists of six relays—two main line and four local—which operate the selective parts of the lower half. The latter consists of three sets of banks of 100 contacts each, one busy and two line banks, arranged in ten rows of ten contacts each, mounted on a semi-circular structure, the axis of which is a vertical rod about the size of a lead pencil, upon which is fixed a short contact arm about one and one-half inches in length. The rod has both a vertical and rotary motion, each controlled by one of the magnets above mentioned. These magnets are excellently shown in Figs. 7 and 8. When a subscriber calls seventy-six, for instance, the rod is lifted vertically by the first motion of the subscriber's dial, which sends a current over one side of the two-wire circuit, thus raising the rod step by step to the seventh row of contacts. The second movement of the subscriber's dial sends the current over the other side of the circuit, and the controlling movement gives a rotary motion to the rod, which moves the contact arm to the sixth contact in the seventh row, thus securing connection with seventy-six. When the caller hangs up his receiver, the current is sent over both wires of the circuit, releasing the selector rod, which goes back to its original position. The magnets, armatures, springs, coils and all parts of the switch are made of high-class material. All bearings are of hardened steel, and the number of parts has been reduced to a minimum.

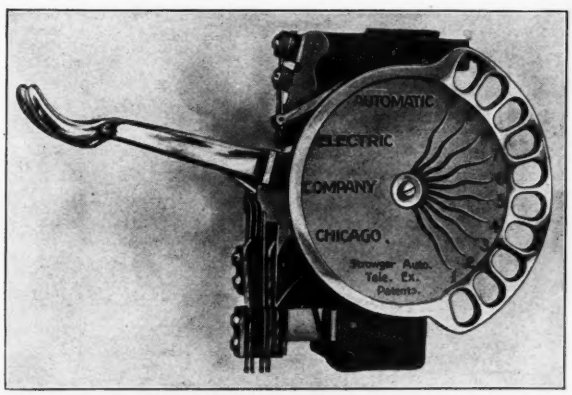


FIG. 5.—KEYBOARD AND DIAL.

Fig. 9 shows the vertical and rotary banks. The three banks of contacts, mounted one above the other, are held in place in the lower part of each switch and secured to the superstructure by two rods of Bessemer steel, which pass through the steel binding-plates at the top and bottom of each bank, and are fastened by four hexagonal iron nuts. The uppermost bank is the "busy" bank, and consists of 100 spring brass contacts arranged in ten rows of ten each, bound and held together by two steel plates, machine screws, and hexagonal brass nuts. The insulation used consists of Empire bond paper treated with linseed oil, with a fibre filling. This linseed oil paper has been found to be the best insulation, as it requires 1,000 volts to break down a thickness of 0.001 of an inch. The paper used in the manufacture of these banks is 0.005 of an inch in thickness, and is further strengthened by a filling of hard fibre. Fig. 9 shows the vertical and rotary banks, which are similar in structure. These banks consist of 100 contacts, arranged in five rows of twenty contacts each. Each row consists of two layers of contacts, ten to the layer, the layers being separated by specially treated insulating strips of fine fibre and linseed oil paper. Each of these banks is bound in the same manner as the bank just described. All banks are wired with

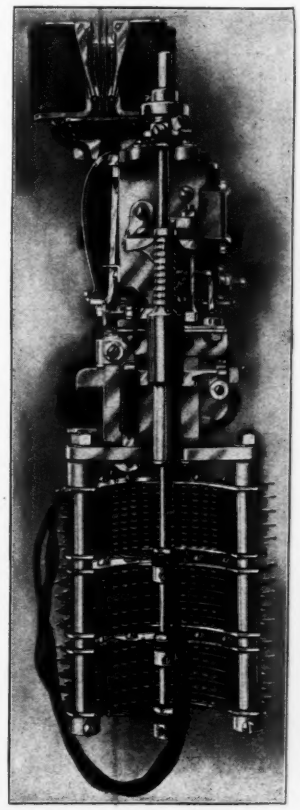


FIG. 6.—FRONT VIEW OF SWITCH.

No. 24 one cotton and two silk, beeswaxed and tinned switchboard wire. The vertical and rotary bank wires are twisted

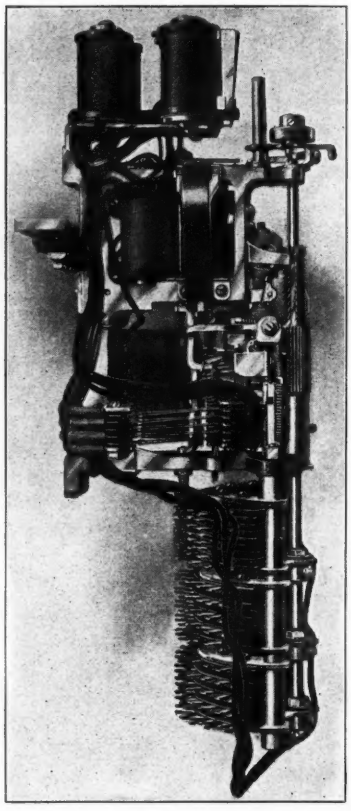


FIG. 7.—SIDE VIEW OF SWITCH.

in pairs throughout the system. Fig. 10 shows a single layer of bank contacts.

Great care must be exercised in wiring the banks for automatic telephone service. A special table has been designed, which enables the workman to avoid mistakes. After the banks are wired they are given a thorough test for insulation, open, crossed, and reversed wires. Each

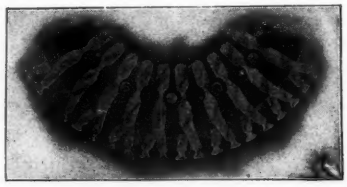


FIG. 10.—SINGLE LAYER OF BANK CONTACTS.

individual contact is tested for these troubles before the switches are mounted on a switch shelf. The automatic switches are mounted on wooden shelves, twenty-five switches to a shelf, each board containing six shelves, or a total of 150 switches. The actual floor space occupied by such a switchboard is eleven feet six inches by eight inches. The floor space required is three by twelve and one-half feet, while the space allowed in making calculations for room is thirty-nine square feet. An important feature

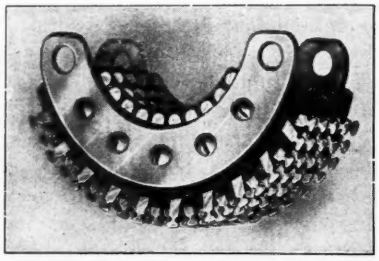


FIG. 9.—ROTARY AND VERTICAL BANKS.

of the automatic switchboard is that it can be increased to any capacity by adding new sections with the desired num-

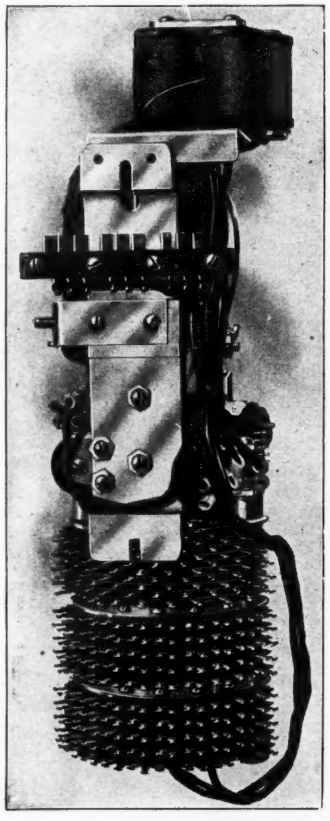


FIG. 8.—REAR VIEW OF SWITCH.

ber of switches mounted thereon. Smaller boards are also designed, containing four shelves with ten switches to the shelf.

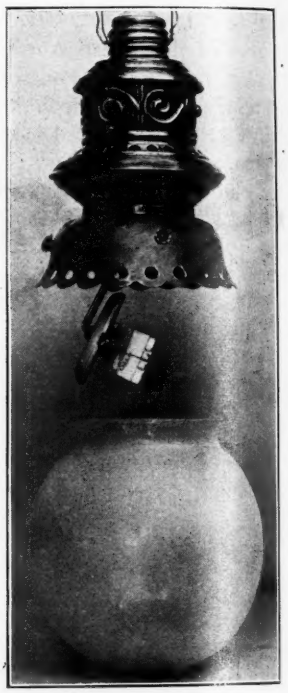
American Institute of Mining Engineers.

The eighty-third meeting of the American Institute of Mining Engineers will be held at New Haven, Ct., beginning October 14, 1902.

Nernst Lamp for Telephone Switchboards.

The Sandusky Plate Company has recently put in a novel Nernst light system for lighting its switchboards. No little trouble has been experienced in obtaining a suitable light for this purpose, as its aim has been to imitate the daylight coming from the skylight in the ceiling which is the most satisfactory, and for both the operators and monitors.

The company appreciating the qualities of the Nernst light took steps to equip the exchange with that system resulting in a lamp being designed for it that throws its maximum light on the switch-



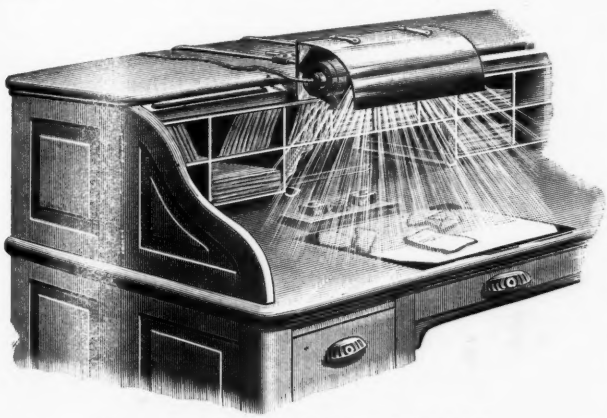
NERNST LAMP DESIGNED FOR ILLUMINATING TELEPHONE SWITCHBOARDS.

board giving a soft pleasing illumination. The lamps used are of the one-glower 110-volt type, with a holder designed to throw the maximum light at an angle of about thirty degrees from the vertical, as shown in cut. They are placed about eight feet from the floor and directly over the operators. Ground-glass globes are used and there is enough light reflected back to give sufficient general illumination to the room, and at the same time the objectionable glare in the monitor's eyes is obviated.

Aside from the quality of the light and pleasing effect it is from an economical point very commendable, as the watt consumption of the Nernst light for a given area to be illuminated is well known.

A Novel Desk Lamp.

In the accompanying illustration is shown an electric desk lamp which is claimed to be constructed upon scientific principles, and to be of great value to those who are compelled to do desk work in darkened places. The hood is so arranged that the light is softened and so distributed as to leave no shadows or dark corners in the desk, the lamp at the same time being entirely shaded from the eyes. The lamp



Novel Parabolic Adjustable Desk Lamp.

is ornamental and adjustable in every direction, and in no way interferes with the opening or closing of a roll-top desk. No special lamp or socket is necessary, and the lamp is claimed to be very popular for this class of service. It is manufactured by the Kinsman Electric and Railway Supply Company, 91 Liberty street, New York city.

Production of Copper.

The production of copper in 1901 is reported by Mr. Charles Kirchhoff in Mineral Resources of the United States, 1901, now in press, United States Geological Survey.

The conditions surrounding the copper-mining industry during the year 1901 were in many respects extraordinary. Production was only slightly less than it had been in 1899 and in 1900, and consumption in this country was undoubtedly considerably greater. But a determined effort was made during the greater part of the year to maintain values in the face of adverse conditions in the countries which are the principal customers for our large surplus. Prices were kept above the parity of Europe, so that large importations were added to the supply. The result was an extraordinary accumulation of the red metal in the hands of leading interests. For a while cooperation between the principal producers was tried, and, when this failed, coercion was attempted by the breaking of the market toward the close of the year. This was preceded by a very serious decline in the shares of copper companies on both sides of the Atlantic.

The total production of domestic copper in the United States in 1901 was 268,782 long tons, as against 270,588 long tons in 1900. The amounts produced and the relative percentages of the total production of Lake Superior, Montana and Arizona were as follows: Lake Superior, 69,772 long tons, percentage of total production, 25.9; Montana, 102,621 long tons, percentage, 38.2; Arizona, 58,383 long tons, percentage, 21.7. Mr. Kirchhoff discusses at some length the conditions and production of the mines in the Lake Superior district, in Montana, in Arizona, in Utah, and in Tennessee.

New Five-Ampere Snap Switch.

The accompanying illustration shows a good example of recent evolution in switch construction. This switch is somewhat smaller than most switches of its capacity, yet, owing to the construction of the mechanism of nickeled steel and

New Five-Ampere Snap Switch.

the very efficient design of the contacts, the switch is reported to carry very much greater current than its rated capacity.

Another novel feature is the cover lining, which is drawn up from a solid sheet of fibre the same way that metal is drawn, a very difficult thing which heretofore has not been accomplished. The handles, too, are of a special composition guaranteed not to break.

These switches are being manufactured and put in the market by the Marshall-Sanders Company, of Boston, which already reports a very brisk demand, especially in second orders from contractors and others who have used them.

Briarcliff Manor.

The advantages of the telephone and the electric light are well shown in the design of Briarcliff Farms and Briarcliff Manor, in Westchester County, this state. From the electric lighting station of this vast estate, owned by Mr. Walter W. Law, the entire farm, as well as the beautiful Briarcliff Lodge, is supplied with electric light. A herd of over 1,200 head of Jersey cattle is domiciled in a number of barns, where the electric light is used for supplying illumination at all hours, and also furnishing power for ventilation when required. The various greenhouses, of which there are ten, are lighted in the same way. The lodge, which is constructed with rare taste and most attractively located, has a long-distance telephone running into each bedroom, thus placing each guest in communication, if desired, with New York, Boston, Chicago or any place on the long-distance circuit. Mr. Law, the owner, is to be congratulated on his successful utilization of modern inventions—of which the greatest are electrical—in the various departments of his magnificent estate.

This interesting development of modern farming, not yet two years old, was recently visited by a party under the guidance of Mr. George H. Daniels, of the New York Central Railroad. They were entertained by Mr. Law, whose progressive work is setting an example that is being noted the world over.

Two More Keystone Exchanges.

The Kellogg Switchboard and Supply Company, of Chicago, Ill., has just closed a contract with the Keystone Telephone Company, Philadelphia, Pa., for two more common battery multiple relay switchboards of 4,800 lines capacity each, for its fifth and sixth district exchanges, respectively. Included in this contract are a chief operator's desk, wire chief's desk and manager's desk, all of which will be of mahogany to match the main switchboard, together with all necessary power apparatus, relay racks, distributing frames, lightning arresters and sneak-current apparatus. This will make a total ultimate equipment of 34,080 switchboard lines, which the Kellogg company will have furnished the Keystone Telephone Company for its extensive system in Philadelphia.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

A LARGE CONTRACT FOR INDIA—It is reported that the General Electric Company is figuring on a contract to construct an electric lighting and traction system in Bombay, at a cost of over $5,000,000.

TO TELEGRAPH VOLCANO NEWS—Professor La Croix, before starting on his new mission to Martinique, declared that after a survey he will establish posts of observation supplied with proper instruments near Mount Pelee. These posts will be united by telephone with Fort de France, in order to give timely notice of threatening signs and to enable the authorities to take precautions.

FAST ELECTRIC RAILWAY IN BELGIUM—Despatches from Brussels state that the Belgium Government has practically decided to construct an electric railway from Brussels to Antwerp. This will be the first long-distance electric railway in Europe. The contract calls for a speed of a little less than a mile a minute. The distance—twenty-five miles—is to be covered in twenty-six minutes.

TO HARNESS THE RIO DE JANEIRO—Word comes from Buffalo that two South American engineers, at the head of a project involving a capital of $15,000,000, by which the electric power systems of Rio de Janeiro, the capital of Brazil, are to be centralized in one great plant, with a capacity of 40,000 horse-power, are inspecting the power plants at Niagara. To supply electric power for 1,000,000 people of Rio de Janeiro, power is to be generated from the Parahaba River, ninety miles from the city. According to both engineers, the capital of $15,000,000 has already been subscribed, seventy-five per cent of it being American.

WILL INCREASE CAPITAL—It is announced that the capital of the Rochester, Syracuse & Eastern Railway Company will be increased from $3,500,000 to $5,000,000. A branch of the road will be built from Lyons or Clyde to Sodus Bay, a distance of twelve miles, and that Ontario Lake resort will be the terminal of the excursion branch. The company has franchises and rights of way for this branch, and a branch to run along the prominent highways. The permanent survey has been made east to Macedon, and the rights of way secured. Ten thousand tons of iron are already on hand, and 200,000 ties are strung along. The preliminary survey makes the route about eighty-six miles, but the permanent survey may shorten this about a mile. A power-house, to cost $700,000, will be built between Lyons, Clyde and Newark.

NEW TROLLEY SYSTEM FOR CUBA—A corporation capitalized at $1,000,000, is to build a street railway system in Havana and its environs in Cuba, the line being projected from Havana to the south coast, the other terminal being at Baraboa, an important southern seacoast town. The distance from Havana to Baraboa is thirty-six miles. George Denison, of the banking firm of Denison, Prior & Company, of Cleveland, and W. H. Parke, of Youngstown, compose an investigating committee sent by the syndicate to Cuba to look over the ground and inspect the franchises secured by the company on the island. The carrying of the products of this fertile country from the interior to the coast is an important feature, and it is believed that a line with electric propulsion will be more effective and cheaper than one of steam. The principal capitalists concerned in the project are: W. H. Parke, H. G. Hamilton, of Youngstown; Denison, Prior & Company, of Cleveland; George F. Penhale, of New York, and Banker Davitt, of Chicago.

WIRELESS SIGNALS ACROSS THE ATLANTIC—It is expected that William Marconi will reach the United States very shortly on the cruiser Carlo Alberto, which has been placed at his disposal by the Italian Government, and which is fitted out with a wireless system. Upon his arrival in America, it is understood that Mr. Marconi will immediately begin his last series of experiments preparatory to the establishment of a commercial wireless service across the Atlantic. While crossing, the Carlo Alberto will constantly send communications to the English side, so that everything will be ready at the moment of her arrival, when Mr. Marconi anticipates flashing a signal which will be the culmination of the work of years. Word has been received in the New York office of the company representing Mr. Marconi's system that remarkable success has been achieved in sending and receiving wireless telegrams on a recent trip up the Mediterranean. While aboard the Spanish man-of-war, which the government has placed at his disposal, Mr. Marconi states that he sent and received messages across France and Spain, and over the Alps and across the Mediterranean.

INCANDESCENT ELECTRIC LAMPS IN THE NETHERLANDS—There are about 500,000 incandescent electric lamps used annually in the Netherlands. Most of these lamps are imported, the principal portion coming from Germany, and a small percentage from England, Belgium and Switzerland. Glow lamps are imported in every quantity from lots of 50 or 100 to 1,000 or more. The market price per lamp for 1902 is quoted at about twelve cents. Various discounts are granted, according to the size of the order given. The import duty on electric lamps is five per cent of the value, inclusive of packing, and there are no regulations restricting the importation of lamps. The competition in this line is very keen, and purchases are largely governed by price considerations. Generally speaking, the people of the Netherlands are favorably inclined toward American manufactures, and if American lamps can compete in price and quality with those of German manufacture, there will undoubtedly be a good market for them. Electricity is slowly but surely taking the place of gas and oil. There are no special underwriters' regulations applying to incandescent lamps in the Netherlands with reference to the base of the lamps.

TELEPHONE AND TELEGRAPH.

MORRIS, N. Y.—A project is on foot for extending the Farmers' Telephone Line from the terminus at Turtle Lake to Peckton, thence to Edmeston, and on to New Berlin.

BRIDGETON, N. J.—The city council has given the Interstate Telephone Company a perpetual franchise, with the exclusive right to lay conduits under the streets for its wires. The company will at once proceed to spend about $20,000 for a new plant.

LIMA, N. Y.—The village board of trustees has granted a franchise to the Inter-Ocean Telephone and Telegraph Company to put in a telephone system. Work must begin within six months and the system be completed within nine months or the franchise will become void.

MIDDLETOWN, N. Y.—The Wawayanda Telephone Company has been reorganized, and connection will be made with the Hudson River Telephone Company, which will give subscribers long-distance connection. The officers of the company are as follows: President, H. T. Stage; secretary, R. V. Ryerson; treasurer, James McVeigh; superintendent, H. J. Shelley.

CLEVELAND, OHIO—The Everett-Moore Syndicate has changed its plans with reference to the Federal Telephone Company, and no further effort will be made to bring about a reorganization of that concern. Mr. Henry A. Everett has stated that the intention is to fully protect the stockholders of the Federal company and to bring about a dissolution of the company in a few weeks. The United States Telephone Company and the Cuyahoga Telephone Company will be handled as separate properties.

KINGSTON, N. Y.—At the annual meeting of the Citizens' Standard Telephone Company, recently held, the following officers were elected: J. E. Klock, president; Charles Reynolds, Jr., secretary and treasurer. Directors: T. M. Brush, I. H. Griswold, S. B. Rawson, Elyria, Ohio; Howard Hendrickson, Albany; Charles A. Schultz, Mortimer C. Drake, Jay E. Klock, Kingston. During the year connections have been made with the following twenty-one additional points: Blooming Grove, Central Valley, Chester, Cornwall, Cornwall-on-Hudson, Esopus, Greycourt, Highland, Highland Mills, Marlborough, Milton, Monroe, Mountainville, Newburgh, Oxford Depot, Poughkeepsie, Salisbury Mills, Turners, Vail's Gate, Washingtonville, Woodbury Falls. Many improvements have been made during the past year. Over 25,000 feet of cable have been put in Kingston, and a new switchboard of the latest improved pattern has been installed in the Rosendale exchange.

ELECTRICAL SECURITIES.

Although during the early part of the week the bullish sentiment was so strong that little attention was paid to the indications of a growing monetary stringency, this condition made itself felt in the latter half of the week, particularly on Friday, when loans were made at twenty per cent, with the bulk of the day's business done at twelve per cent. The last bank statement, showing surplus reserves practically wiped out and only $715,000 above the lawful requirements, indicates better than anything else the necessity for a close watch to prevent over speculation. The developments of Saturday, however, brought on an improved monetary outlook, and in consequence the speculative sentiment is still very cheerful. This betterment is largely due to the action of the Secretary of the Treasury, in ordering the discount of the October government debt interest, and also the announcement that government deposits will be immediately increased in new depositories having the necessary government bonds as security. This will realize about $8,000,000 from the government vaults, and nearly one-half of this will be immediately available, as this amount is payable in New York city on government bonds. Further early aid to the stringency of the money market is also looked for through the foreign exchange market. Another important factor in the general situation that accounts for professional confidence in the speculative outlook is the belief that the coming week will show a material change for the better in the coal strike situation. The early frosts have caused quite an extensive rumor of damage to the corn crop. At the very worst, however, it is believed that the agricultural yield will prove more favorable to continued national prosperity than that of last year.

ELECTRICAL SECURITIES FOR THE WEEK ENDING SEPTEMBER 13.

New York:	Closing.
Brooklyn R. T.	68½
Con. Gas	223½
Gen. Elec	192
Kings Co. Elec	212
Man. El	134¾
Met. St. Ry	147
N. Y. & N. J. Tel. Co	183
Westinghouse Mfg. Co	228

There has been a renewed demand for the stock of the New York & New Jersey Telephone Company during the week. Lots aggregating about 300 shares have been sold at from 180 to 185. There is at present also a good demand for Kings County Electric and Power Company, and 210 is bid for lots aggregating 50 to 100 shares.

A quarterly dividend of 1 per cent on the capital stock of the Manhattan Railway Company has been declared, payable on and after October 1, 1902.

The Commercial Cable Company has declared the regular quarterly dividend of 1¾ per cent, to be paid October 1, 1902.

The Western Union executive committee has recommended the payment of the regular quarterly dividend of 1¼ per cent.

Otis Elevator directors have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable October 15.

Boston:	Closing.
Am. Telep & Tel	169⅞
Edison Elec	275
Mass. Elec. pf	96½
New England Tel	141½
Western Telephone and Telegraph	100

Philadelphia:	Closing.
Elec. Co. of America	9¼
Elec. Stor. Bat. c	89
Elec. Stor. Bat. pf	87¼
Philadelphia Elec	8 7/16
Union Traction	47¾
United G. I	112⅛

Union Traction, Electric Company of America and Philadelphia Electric all suffered small losses, though Philadelphia Electric showed considerable firmness under protracted selling.

Chicago:	Closing.
Chicago Edison Light	174
Chicago Telep	171
Metropolitan El. pf	89
National Carbon	33
National Carbon pf	100½
Union Traction	18¼
Union Traction pf	51

Lake Street Elevated shares was one of the leading features of the market, and National Carbon was also strengthened materially on additional purchases.

PERSONAL MENTION.

MR. J. S. THOMSON, who is well known in machinery and electrical circles in New York city from his connection with the New York Safety Steam Power Company, was married on September 3 at Cleveland, Ohio, to Miss Elsie Thomson, of that city.

MR. P. M. FLETCHER, who has been prominently connected with the New York branch of the Western Electric Company, has recently identified himself with the Burnett Company, of New York, which company is entering the field as dealers in electrical supplies.

MR. C. P. PLATT, of the sales department of the Kellogg Switchboard and Supply Company, of Chicago, is confined to his house with typhoid fever. Mr. Platt has a wide acquaintance in the electrical field, and his many friends extend the hope that he will be favored with a speedy recovery.

MR. HENRY L. SHIPPY, of the John A. Roebling's Sons Company, recently returned from a visit to London where he attended the coronation of King Edward. Mr. Shippy is one of the greatest travelers in the electrical field, and his widely diversified interests have made him acquainted with all parts of the globe.

MR. ALEXANDER C. HUMPHREYS has accepted the position of president of the Stevens Institute of Technology, at Hoboken, N. J., succeeding the late Henry Morton. Mr. Humphreys was graduated from the Stevens Institute, and is now senior partner of the firm of Humphreys & Glasgow, gas engineers, of New York and London.

MR. GEORGE R. FOLDS, who for many years has been prominently connected with the Twin City Rapid Transit Company, of Cincinnati, and for the last three years claim agent of the company in St. Paul, is to become one of the attorneys for the Brooklyn Rapid Transit Company. He will probably engage in his new duties this week.

MR. CHARLES E. HEWITT, who has until recently been senior partner of the firm of Hewitt & Warden, Newburgh, N. Y., is now the president of a new company incorporated under the laws of New York, under the name of C. E. Hewitt & Company. The work of the new company will be mainly constructing central stations, making a specialty of marine electrical construction.

MR. A. H. PATTERSON, vice-president of the Phœnix Glass Company, possesses many traits of the true poet. A recent letter to this office happened to contain a blot or two, and the following was added as a rhyming foot-note:

"This sheet is not from Spotless Town,
But addressed to a paper of great renown;
Whose pages are read by readers through—
The journal élite—ELECTRICAL REVIEW."

OBITUARY NOTICES.

MR. SAMUEL D. BABCOCK, aged eighty-one years, a banker of New York, died suddenly of heart failure at Lenox on Sunday evening, September 14. Samuel Dudley Babcock was one of the best known financiers and railroad men in New York. He was born in Stonington, Ct., May 16, 1822. With the exception of Russell Sage, he was the oldest man in active business in the Wall street district. His career as a railroad man began in 1854, when he entered the service of the New York, Providence & Boston Railroad Company. He showed so much ability than in less than five years he was made a director of the road, and in 1867 he was elected its president. Since then Mr. Babcock has been an officer in many of the most important railroads and financial institutions in the East. At the time of his death he was president, vice-president or director in twenty-one corporations. Among these were the International Bell Telephone Company, Limited; New York & Harlem Railroad, and New York Central & Hudson River Railroad. Mr. Babcock's wife died several years ago, but he is survived by seven children—one son and six daughters.

ELECTRIC RAILWAYS.

NEWARK, N. J.—The North Jersey Street Railway Company is enlarging its power plant. Some $250,000 will be expended for this purpose.

GREENVILLE, PA.—The council has granted a sixty-year street-car franchise to the East End Railway Company. The road must be completed within eighteen months.

OAK PARK, CAL.—The Aurora, Elgin & Chicago Electric Road has been opened for business. The road runs through Oak Park along the line of the Wisconsin Central.

ROCHESTER, N. Y.—The Rochester & Southern Traction Company has been organized for the purpose of building an electric road from Rochester to Hornellsville. The road will be fifty-six miles in length.

NEWCASTLE, PA.—The Newcastle Traction Company and the Newcastle & Sharon Electric Railway have reached an agreement whereby the latter will be enabled to operate its cars to the centre of the city.

HARRISBURG, PA.—A charter has been issued to the Cumberland & Perry Electric Railway Company to connect Carlisle and Loysburg by trolley. The company has a capital of $120,000 to erect a line twenty miles long, connecting the two points.

INDIANAPOLIS, IND.—The Fort Wayne & Southern Traction Company has amended its articles of incorporation so that the road will have power to construct, lease or purchase lines of railway in Fort Wayne, Bluffton, Montpelier, Hartford City, Huntington, Van Buren and Marion.

WASHINGTON, PA.—A trolley line from Washington and Canonsburg is being built by the Canonsburg & Washington Street Railway. The line will be nine miles long and will cost in the neighborhood of $300,000, and it is hoped that it will be in operation by May 30, 1903.

TOLEDO, OHIO—Mr. John O. Zubel, of Marion, Mich., is authority for the statement that a new electric road will be built from this city to Ann Arbor, a distance of forty-seven miles, touching at Petersburg, Milan and Dundee. The road will be in operation within a year.

OAKLAND, CAL.—Mr. B. H. Griffeths states that the company in which he is interested expects to issue bonds for $1,000,000 to build a system of electric roads in and about Stockton. Some of the franchises necessary have already been obtained, and others are pending before the supervisors.

STROUDSBURG, PA.—Work on the construction of the Easton & Belvidere trolley line will shortly be commenced. Arrangements have been made to join the tracks of the Lehigh Valley Traction Company at Belfast, continuing over the already acquired right of way to Easton, a total distance of seventeen miles.

RIDGEFARM, IND.—The town board of Ridgefarm has granted a franchise for an electric line on the streets of the village. This is part of the line that is to run from Terre Haute to Danville, the promoters of which are the Stone & Webster Syndicate of Boston. The cost of the road will be in the neighborhood of $1,500,000.

SYRACUSE, N. Y.—Steps will be taken at once for a new survey of the route of the Rochester, Syracuse & Eastern Railway, and it is also stated that the capital of the company will be increased from $3,000,000 to $5,000,000. The road is to be about eighty-six miles in length, and it is hoped to have it completed within two years.

DELPHIA, IND.—A stock company, composed of the following business men, has been organized to build the Delphia belt road: Will C. Smith, John Ruffing, J. H. Burr, I. Dreifus, J. A. Shirk, William Donlin, J. H. Mount, M. M. Murphy, S. W. Barnett, J. A. Cartwright, Lewis Hall, G. W. Julian, A. H. Bremer, H. Kerlin and L. D. Boyd. The company will be incorporated at once.

WHEELING, W. VA.—The city council has granted a franchise to the Buckhannon & Northern Railway Company, giving the company privileges to lay its track through the city on the west side of Tygarts Valley River. A franchise has also been granted to a home enterprise, headed by B. F. Bailey, C. H. Straub, T. E. Joyce and Eugene Sommerville, to lay a street railway through the city.

PUEBLO, COL.—The consolidation of the Colorado Springs Suburban Company and the Rapid Transit Company has been effected, and the properties taken over by the Colorado Springs & Interurban system, which was recently formed by W. S. Stratton and others. It is the ultimate intention of Mr. Stratton to build electric lines to Cripple Creek, Pueblo and other southern Colorado towns.

INDIANAPOLIS, IND.—It is stated that the Indianapolis Street Railway Company is preparing plans for the construction of an electric road between Indianapolis and Cincinnati. The road will pass through Morristown, Rushville, Liberty and Hamilton. Indianapolis men will build from Indianapolis to Rushville, and Cincinnati parties will construct the portion of the line from Hamilton to Rushville.

RALEIGH, N. C.—The state has chartered the Carolina & Tennessee Southern Railway for 999 years, to extend from Franklin, Macon County, down the valley of the Little Tennessee River to a point where it enters Tennessee, a distance of sixty miles, with a capital of $300,000. The directors of the company are: A. B. Andrews, W. W. Finley, H. C. Ansley, Fairfax Harrison, H. W. Miller and F. H. Busbee.

HARRISBURG, PA.—The Dillsburg & Allen Electric Street Railway has been chartered with a capital of $50,000. The incorporators are: Peter Sidle, John H. Dick, Daniel W. Beitzel, George W. Cook, Dillsburg; J. C. Hutton, Harrisburg. The road will be six miles long and will run from Dillsburg to Beavertown, to Williams' Grove, to Kunkel's Mill, to Allen or Churchtown, to the line of the Cumberland Valley Traction Company.

WAUKON, IOWA—The Iowa Hematite Railway Company has filed a trust deed in the office of the recorder of Alamakee County to cover $1,500,000 bonds of $1,000 each at five per cent, payable in twenty years, floated by the State Bank of Chicago. The road is to connect Lansing, Waukon and Decorah by electric railway, the main object, however, being to develop on a larger scale the Waukon iron mines, where millions of tons of ore are easily accessible at the surface.

ALLENTOWN, PA.—John H. Pascoe and J. Marshall Wright, of this city, are securing the rights for the new Perkiomen Valley trolley line which will be built next year. It will connect with the Johnson system near Emaus, Lehigh County, and will extend forty miles to Collegeville, touching Zionsville, Hereford, Palin, East Greenville, Pennsburg, Red Hill, Green Lane, Sumneytown, Zieglersville, Schwenksville, Harleysville and Collegeville. It will form part of the Johnson line.

OGDENSBURG, N. Y.—The Northern New York Railroad, which was granted a special charter eight years ago by the legislature to construct a line from Schenectady, through Saratoga, Fulton, Hamilton and St. Lawrence counties to a point on the St. Lawrence this city, will soon be built, it is rumored. The company, under a former law, and through concessions granted by the state, has the sole right to the route described, a privilege which under lately enacted laws no railroad can now secure.

PRINCESS ANNE, MD.—The directors of the Princess Anne & Island Light, Power and Railway Company have elected the following officers: President, H. P. Dashiell; treasurer, O. T. Beauchamp; secretary, William F. Lankford. The directors of the company are: J. F. Sweeten, of New Jersey; J. R. Millard, of Pennsylvania, and O. T. Beauchamp, W. F. Lankford, Roger Woolford, H. P. Dashiell, James T. Bennett, S. F. Dashiell and B. P. Miles. The proposed road is to run from Princess Anne to Deal's Island, in Somerset County, with lateral branches.

TOLEDO, OHIO—The People's Rapid Transit Electric Company has been incorporated under the laws of the state of Ohio, and directors and officers have been elected as follows: President and general manager, J. Morgan; vice-president, M. A. Merkley; second vice-president, T. M. Franey; secretary, L. J. Weadock, and treasurer, A. Burger. The board of directors consists of the foregoing officers and G. Bloodhart and W. P. Heston. The line is to start at Napoleon, running southwest through Napoleon, Defiance, then south to Paulding, Van Wert, Celina and Greenville, connecting at Greenville with the Dayton & Western, giving through service for passengers and freight for Cincinnati, Hamilton, Middletown and Dayton. Including all branches, the road will be from 150 to 250 miles long when completed. It is hoped to have the division from Toledo to Defiance open in from six to eight months.

ELECTRIC LIGHTING.

BETHLEHEM, PA.—A new power plant for the Lehigh Valley Traction Company is to be built in this city.

PANA, ILL.—The city council has awarded a contract for the erection of a municipal electric light plant to T. C. Reid, of St. Louis.

OSKALOOSA, IOWA—The Oskaloosa Traction and Power Company has commenced work on a $200,000 power plant and car system.

CANASTOTA, N. Y.—The Canastota & Morrisville Railroad has had plans prepared for the new power-house to be built at Canastota, which will cost about $100,000.

DANSVILLE, N. Y.—The Mill Creek Light and Power Company has secured a contract to light the village for a term of five years from August 1, 1903, for the sum of $3,000.

LOS ANGELES, CAL.—The Pacific Light and Power Company, capitalized at $10,000,000, will issue bonds to an equal amount. It is said that several companies will be absorbed.

MADISON, WIS.—The work of installing the new lighting and ventilating plant in the state house has been commenced, and the work will be pushed so as to have it completed by January. The entire cost of the improvement will be $60,000.

LANCASTER, PA.—The power plant of the Lancaster County Railway and Light Company has been put in operation, and will supply power for all the trolley lines in this county and the electric lighting of this city. The cost amounted to nearly $500,000.

FAIRMONT, W. VA.—The Fairmont Gas and Electric Company has closed a deal with the Fairmont & Grafton Gas Company, whereby the former becomes the owner of all the rights of the latter company in this city. The price paid was $1,050,000, and possession has already been given.

PLAQUEMINE, LA.—The city council has granted a franchise for a term of twenty-five years to Frederic Wilbert, H. N. Sherburne, Jr., Dr. W. A. Holloway, C. P. Harrell, C. K. Schwing and John Wilbert, to establish and operate an electric light and power plant. Work is expected to begin at an early date.

NEWBURYPORT, MASS.—At a meeting of the directors of the Newburyport Gas and Electric Company recently held, Charles F. Pritchard, of Lynn, Andrew W. Rogers, of Beverly, Sidney W. Winslow and Herbert F. Winslow, of Boston, were elected directors, vice E. P. Dodge, W. R. Johnson, L. B. Cushing and D. D. Tilton, resigned.

LA FAYETTE, IND.—Plans are said to be well under way for the construction of a large electric power plant at Horseshoe Bend, eight miles south of Monticello. A tract of forty acres at this point on the Tippecanoe River has been purchased by Charles Meeker and other La Fayette capitalists. It is proposed to furnish electricity for power and lighting to Delphi, La Fayette, Monticello and other neighboring towns, and for the proposed electric line along the old Wabash canal.

WASHINGTON, D. C.—The United States Electric Lighting Company is to be absorbed by the Potomac Electric Power Company. The sale will take effect September 30. The consideration paid for the United States Company's property is $3,250,000 of the stock of the Potomac Electric Power Company. The latter company has filed with the recorder of deeds a certificate of reorganization. The paid-in capital is increased from $1,000,000 to $5,000,000, divided into shares of $100 each.

ATLANTA, PA.—The Atlanta Water and Electric Power Company, which will build the $1,000,000 dam across the Chattahoochee River, with the object of furnishing the city of Atlanta with electricity, has been organized, and the following officers were elected at the first meeting of the stockholders: S. Morgan Smith, of York, Pa., president; Forrest Adair, of this city, vice-president. The board of directors is as follows: S. Morgan Smith and C. Elmer Smith, of York, Pa.; George S. Smith, of Pittsburg, Pa., and Forrest Adair and Jack C. Spalding, of Atlanta. The company is capitalized at $1,500,000, all of which stock is taken.

BELLEVILLE, ILL.—A Chicago-Cincinnati syndicate, represented by H. M. Byllesby and W. N. Corner, of Chicago; Rudolph Kleibelt & Company, of Cincinnati; Turner & Header, of Belleville, and Stephens, Turner & Foreman, of East St. Louis, have purchased the plant of the Belleville Electric Light and Coke Company. The price paid was $300,000, which is double the par value of the company's stock. The syndicate announces its intention of connecting the cities of Belleville and East St. Louis, which are fifteen miles apart, with a system of gas, water and electricity, and is also negotiating for plants in all southern Illinois cities.

AUTOMOBILE NOTES.

CHAMPIONSHIP RACES FOR AUTO VEHICLES—Championship races will be held at Narrangansett Park, Providence, R. I., September 24, by the Rhode Island Automobile Club. The class races are very comprehensive, and include practically every vehicle that is entitled to be called an automobile. Narragansett Park is famous for one of the fastest mile tracks in the country. The surface is clay which, under proper racing conditions, is rolled hard to the smoothness of asphalt, the banking being very carefully attended to. There are nine classes altogether, the prizes amounting in all to $1,225, there being a first and second prize for each event, except in the sweepstakes open to all winners of regular classes for five miles. The time for entrance will close September 22 with Secretary H. H. Rice, at the Grand Hotel, Providence. The entrance fee is $10. Awards will be made in cash or plate, but money is specified on the programme which has been issued to ensure full value.

FIVE-HUNDRED-MILE RELIABILTY CONTEST—The Automobile Club of America will hold a 500-mile reliability contest from New York to Boston and return October 9 to 15, 1902. The contest committee is composed of Winthrop E. Scarritt, George F. Chamberlain, John A. Hill and S. M. Butler, secretary. The itinerary is as follows: October 9, first day, New York to New Haven, luncheon at Norwalk; October 10, second day, New Haven to Springfield, luncheon at Hartford; October 11, third day, Springfield to Boston, luncheon at Worcester; October 12, fourth day, Sunday, in Boston; October 13, fifth day, Boston to Springfield, luncheon at Worcester; October 14, sixth day, Springfield to New Haven, luncheon at Hartford; October 15, seventh day, New Haven to New York, luncheon at Norwalk. This contest has been organized with a view of affording an opportunity for the various types of motor vehicles to demonstrate their reliability under circumstances as closely as possible simulating general touring conditions in the United States. The contest committee desires to lay especial stress upon the fact that speed in excess of the legal limit will be absolutely prohibited upon penalty of disqualification, general reliability being the underlying feature of the contest. The time for receiving entries will expire on September 25, and the contest will be open to all classes of self-propelled vehicles made in the United States and abroad, so constructed that at least two passengers are carried, seated side by side; but no manufacturer, agent or private owner shall be allowed to enter more than three vehicles in any one class. Vehicles shall be divided into the following classes: Class A, four-wheel vehicles weighing under 1,000 pounds in commercial running and operating condition with all fuel, tools and supplies on board; class B, four-wheel motor vehicles weighing over 1,000 pounds and less than 2,000 pounds in commercial running and operating condition, with all fuel, tools and supplies on board; class C, four-wheel motor vehicles weighing 2,000 pounds or over in commercial running and operating condition, with all fuel, tools and supplies on board; class D, motor bicycles, motor tricycles and motor quadricycles. Electric vehicles may charge or replace batteries at noon and night without penalty; all other recharges or replacements will be counted as penalized stops, and the length of time thus consumed will be counted by the observer. Every vehicle will carry an official observer, who will be provided by the club. Controls are to be officially established at the beginning and at the end of each day's run. The start is to be made each morning at nine o'clock, and an hour and a half will be allowed for luncheon, except that any contestant arriving at the noon control at one o'clock or after will be allowed one hour for luncheon. He will be called one hour from the time of his arrival, and his time will be counted from the time that he is called. But no vehicle will be allowed to leave the noon control before two o'clock.

INDUSTRIAL ITEMS.

THE FRANKLIN MACHINE WORKS, Philadelphia, Pa., have issued a finely printed catalogue descriptive of horizontal boring, milling and drilling machines, cold saw-cutting machines and plane milling machines. This will be sent to any one interested upon application.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., selling agent of the Packard incandescent lamp, has received hundreds of testimonials resulting from a request to its customers for their opinions regarding the lamp. These are now being exhibited as a chain of evidence as to the quality of Packard lamps.

A. L. DYKE, St. Louis, Mo., has just issued a new sixteen-page catalogue descriptive of new ignition devices, showing methods of wiring up and properly insulating the jump-spark system which is now so universally used. This pamphlet is profusely illustrated, and will be sent to any one interested upon application.

THE C. W. HUNT COMPANY, West New Brighton, Staten Island, N. Y., is distributing an illustrated folder describing the industrial railways for shop transportation. The booklet describes the application of different motive powers and shows comprehensively the wide variation of service which this application of carriers may enter.

THE INTERNATIONAL MOTOR CAR COMPANY, Toledo, Ohio, is distributing an attractive pamphlet illustrating and describing a sixteen-horse-power gasoline touring car. The machine is illustrated both in half-tone and diagrammatically. Each part is carefully indexed and furnished with reference marks, and the pamphlet gives a comprehensive idea of the construction of the vehicle.

THE MICA INSULATOR COMPANY, New York and Schenectady, announces that it is making an addition to its plant which will increase the output fifty per cent, and enable the company to fill all orders very promptly. The company was led to take this step in order to meet the increasing demands of the trade for its well-known specialties, micanite goods, Empire goods and M. I. C. compound.

THE PHOENIX GLASS COMPANY, Pittsburg, Pa., is distributing a booklet which gives the dimensions of the different inner and outer globes it manufactures. The book is carefully indexed, and will be of considerable value to any one who may be contemplating the purchase of inner or outer globes for arc lamps. This booklet will be sent to any one interested upon request to the company.

THE CONSOLIDATED RAILWAY ELECTRIC LIGHTING AND EQUIPMENT COMPANY, New York city, has secured the contract of equipping Mr. George Gould's private car Atlanta, now being completed at the car works, at St. Charles, Mo., with the Consolidated axle-light system of electric lights and fans. This car, it is stated, will be a veritable rolling palace, and it is understood that the ultimate cost will reach $150,000.

THE AUTOMATIC WATER PURIFYING COMPANY, New York, reports a large business for the coming year. Among others, it is now erecting plants for the following companies: Pittsburg & Lake Erie Railroad, two, with a capacity of 300,000 gallons each; General Chemical Company, one, capacity 120,000 gallons; Solvay Process Company, Syracuse, N. Y., one, capacity 210,000 gallons; Blatz & Brother, one, capacity 124,000 gallons.

THE LANE & BODLEY COMPANY, Cincinnati, Ohio, is planning a foundry for its own Corliss engine business, and, secondarily, for a jobbing foundry. The building will be 120 feet wide, and of indefinite length. The land owned will admit of an extension of about 1,000 feet. It is proposed to make this factory one of the most complete and one embracing the greatest facilities for all conditions of service that has ever been installed in this country.

G. M. GEST, 277 Broadway, New York city, electric subway contractor, is distributing a folder describing and illustrating the Gest conduit terminals. By the use of this adjustable conduit ring, which may be adapted to any multiple of conduit, a neat and finished entrance is established, and the cables are safe from danger against sharp and protruding edges. These conduits are made from vitrified clay, the same as the best conduit material. Full information will be sent upon request.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., general selling agent for the "A.-B." arc lamps, reports that the demand for these lamps is increasing steadily. The company anticipates a very heavy fall business. Over 100,000 of these lamps are now in general use, and they are rapidly being adopted by many of the largest cities. The manufacturer has lost no opportunity to improve the lamp in every way, and claims to have one of the simplest and strongest lamps on the market. A number of bulletins describing these lamps will be mailed on application.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, has adopted a novel series of booklets descriptive of the manufacture of electric lamps. No. 1 of the series has pasted to two flyleaves—one on the left and one on the right of the reading matter—two pieces of filament. One is a piece of cellulose filament unbaked, and the other is the filament after it has been baked and treated. This is a decided departure, and the Buckeye company is to be complimented for bringing in this way its method of manufacture to the attention of any one who is interested enough to send for the booklet.

THE HARRISON SAFETY BOILER WORKS, Germantown Junction, Philadelphia, Pa., is distributing copies of its latest pamphlets "That No Scale Shall Form in Boilers," advertising the Sorge-Cochrane system for the thorough heating and purification of water for boiler feed and other purposes, together with another recent booklet, "Economy for Collieries," advertising the Sorge-Cochrane system of feed-water heaters and purifiers. These booklets are both of interest to station managers and prospective users of steam in any capacity. They will be sent to any one interested upon application to the company.

THE WATERBURY BRASS COMPANY, Waterbury, Ct., has ready for mailing a new stock catalogue, classifying brass, copper, bronze and German silver in sheets, rods and wire; also brass and copper seamless drawn tubing, which has been carried in the New York warehouse. This catalogue also illustrates mouldings, brass ferrules and checks. A complete table of weights and measures bearing on brass and copper sheets, wiring and tubing has been compiled, and electrical manufacturers and buyers in general of brass and copper will find this a very valuable booklet. This will be sent to any who are interested upon request.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., embellishes its unique September calendar with a half-tone reproduction of the Wood automatic motor starter. The company is also distributing a unique photograph of a transformer struck by lightning. During a severe electric storm the lightning entered a thirty-light "type A" oil transformer, the discharge blowing the fuse and bursting the cast-iron cover. The superintendent of the Monroeville electric plant assures the company that the coils were not injured in the least. Other bulletins describe the types "LB" and "MPL" direct-current, belted generators, and the single-phase type "WAL" generator, the "SAC" integrating switchboard wattmeters, type K, and the enclosed direct-current series arc lamp, differential type, form C.

THE VICTOR ELECTRIC COMPANY, 55 to 61 Market street, Chicago, manufacturer of electrosurgical specialties, reports a very large business in its various devices. The transformer for eye massage has obtained the endorsement of a great many of the leading physicians and surgeons as being capable of improving the eyesight by massage. A pump connected with the instrument produces a suction, awakening the nerves to renewed use, thereby arresting paralysis and improving the sight. Considerable success is also claimed for the Victor electromechanical vibrator, especially efficacious in stomach trouble and similar ailments, but which can be easily applied to any portion of the body necessary.

THE H. B. CAMP COMPANY, Pittsburg, Pa., has established its general sales office in New York city at 170 Broadway, in charge of Mr. H. M. Keasby, eastern manager of the company. The Pittsburg factory is under the direct control of Mr. Camp. The company expects to do a large business during the coming year, and among the large orders which have been secured for its vitrified clay conduits for electric wires may be mentioned those of the Metropolitan Street Railway Company, New York city; the North Jersey Traction Company, Newark, N. J.; C. & P. Telephone Company, Washington, D. C.; the Missouri Bell Telephone Company, St. Louis, Mo., and the Cincinnati Gas and Electric Company, Cincinnati, Ohio. These five orders alone amounting in the aggregate to over 5,000,000 feet of conduit. The H. B. Camp Company installs complete underground conduit systems under the H. B. Camp patents.